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PROPOSED TERMINATION OF LANDSAT 4 AND 5

HEARING

BEFORE THE

SUBCOMMITTEE ON NATURAL RESOURCES, AGRICULTURE RESEARCH AND ENVIRONMENT

OF THE

COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY U.S. HOUSE OF REPRESENTATIVES

ONE HUNDRED FIRST CONGRESS

FIRST SESSION

MARCH 7, 1989

[No. 43]

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PROPOSED TERMINATION OF LANDSAT 4 AND 5

TUESDAY, MARCH 7, 1989

HOUSE OF REPRESENTATIVES,
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY,
SUBCOMMITTEE ON NATURAL RESOURCES, AGRICULTURE
RESEARCH AND ENVIRONMENT,
Washington, DC.

The subcommittee met, pursuant to call, at 2:05 p.m., in room 2318, Rayburn House Office Building, Hon. James H. Scheuer (chairman of the subcommittee) presiding.

Mr. SCHEUER. Good afternoon. This afternoon, the Subcommittee on Natural Resources, Agricultural Research and Environment will come to order, and we'll be considering a problem that has been long building but has now burst on the national scene and has stimulated a great discussion and interest.

There are four Congressman present and we have a long list witnesses, so that in deference to the importance of the subject, the long list of talented and wise witnesses who will be counseling with us, we are going to put all of us, including—I say this most reluctantly—the chairman, under the 5-minute rule, and staff will do their best to enforce this and make sure that our ruthless juggernaut up here keeps cranking ahead on schedule.

This day's hearing is on the—a subject that we discussed last week; namely, the announcement by NOAA—the National Oceanic and Atmospheric Administration—that it will turn off the lights on Landsat 4 and 5 that together constitutes the United States' sole civil remote-sensing system. We will turn off the lights, close the door, and retire from the field. Turning off the satellites with little hope of ever retrieving them, unless by the end of this month NASA comes up with roughly $9.4 million necessary to keep them going until the end of the year. Did I say NASA—yes, NOAA. Excuse me, I misspoke. They originally came to us via NASA. NASA handed them over to NOAA in the late Seventies. NOAA needs to come up with sufficient funding to carry them through the end of the fiscal year, which is September 30th.

It boggles the mind that such a result could even be considered for an instant. What we have here is success. Success is causing us problems. We spent a billion and a half dollars to get into the remote-sensing business, and we achieved a major breakthrough. We got up there, and now the question that arises is how do we cope with success; namely, that these satellites, 4 and 5, are lasting beyond their expected lifetime. In human terms they would be 105 years old. But cranking about their daily business, sending back invaluable information at a zero cost basis to us in terms of capital

costs because the cost of those rockets have already been amortized, and it is a mere $9 or $10 million a year operating cost to keep this billion and a half dollar investment productive, functioning, and sending information to us.

Now, already through the delays and the hesitations and the backing and filling of the past Administration, the Reagan Administration, who didn't really seem to have any zestful commitment to Landsat 6 and 7, they were delayed several years and there is now a gap. We won't get Landsat 6 up there until 1991. So, if we turn out the lights on Landsat 4 and 5, we will have a gap of about 2 years in which we will have abandoned the field of remote satellite sensing.

We will have disappointed over a hundred countries in the Third World who are relying on this information that we send them, desperately; which they desperately need on when to sow, when to plant, when to irrigate, when to fertilize, when to, ah, sow. Information that is a life and death matter to their families, and we would be deliberately creating a 2-year dark room when we would deny them this information.

Businesses are interested in knowing how Soviet wheat crops are coming along. Prices for U.S. farm crops depend on assessments of world grain demand estimated from Landsat data. A wide variety of businesses depend on Landsat for key information about ground water, agriculture, and geology. All of this would die prematurely, would blank out, if we turn out the lights.

There are only two institutions, two groups that are identifiable who would profit from such an aberrational and destructive decision, and those two are, of course, our international competitors in space—the French and the Soviets. If the French or the Soviets had shot down Landsat 4 and 5 or had destabilized them or crippled them in some devious, mysterious way, we would have called that an act of war. And yet, the decision that we're contemplating would do it to ourselves. We would do it to ourselves. We would be shooting ourselves in the foot, and the French and the Soviets must assuredly be laughing all the way to the bank. Because with Landsat 4 and 5, with those lights dimmed and turned off, the French would enjoy a 2-year monopoly courtesy of the United States Government, and the Soviets are already aggressively marketing their own space photography systems and products in the United States in eager anticipation of Landsat's demise.

Whether the United States will recover its competitive position will depend on whether we can produce a well thought out, aggressive, forward-looking commitment to remote space sensing—something clearly not in evidence at this point. Indeed, to the contrary, prematurely turning out Landsat 4 and 5, turning out those lights would——

[Five-minute timer sounds.]

Mr. BROWN. I ask unanimous consent that the chairman may have an additional minute.

Mr. SCHEUER. There being no objection, so ordered. [Laughter.]

We would be telling the U.S., indeed, that we are an inconsistent, unreliable, and unstable partner in space commercialization.

Now there may very well—well, from what we have heard in the last couple of hours, there may very well be some relenting on this

decision. The Bush Administration may very well agree with us on these points. Because it's our understanding—we haven't been informed personally, but it's our understanding from the phone calls we've participated in this morning that, in response to concerns expressed by this committee, by other Members of Congress, by the White House, and by several government agencies that a decision is being made whereby from various points in the compass sufficient funds will be available to continue Landsat further.

We don't know how much—how many funds, how many dollars have been committed. We don't know how long that's going to be. Hopefully, it will be long enough to give Congress a chance to express itself by providing the funds ourselves in the supplemental appropriation bill. But we are somewhat encouraged that the Administration has bought some time by what we hope will be this action. Perhaps not much. It's an 11th and a half hour reprieval, but the executioner is still honing his axe and sharpening his blade.

Questions to the Administration, to the witnesses: Do we have enough funds—will there be enough funding produced to keep Landsat 4 and 5 going through the end of this fiscal year, which is September 31st? Do we have a well thought out, consistent plan to put Landsat back into operation on a permanent basis? Have we made that commitment to ourselves and to the public and to the world? Has the Administration engaged in thoughtful planning to develop a coherent, long-term Landsat policy?

We have invited a large number of government and private witnesses here today to explore these critical unresolved questions, and I'm sure that with their, their varied and vast experience with Landsat that we'll have some useful and enlightening testimony from them.

And now I will yield to our—a junior member of our committee from Texas, a very thoughtful and very committed member of this committee, Lamar Smith, of Texas.

Mr. LAMAR S. SMITH. Mr. Chairman, I want to begin by thanking you and our colleague, Congresswoman Claudine Schneider, for your efforts to address the funding needs of Landsat operations. You can be sure that I share your concerns that the lost of these Landsat satellites will pose a serious and unacceptable interruption of remote-sensing data for government and private sector scientific users.

We should not abandon the Federal Government's substantial $1.5 billion investment in this system, nor should we undermine the ongoing Landsat commercial initiative. The Land Remote Sensing Satellite successfully supports a wide range of information needs. Of particular interest to my constituents is the data related to oil and mineral exploration that these satellites compile and then make available to private companies. It is my understanding that some user government agencies and departments have already agreed to contribute funds to meet the immediate funding needs of Landsat. NASA, and the Department of Defense deserve to be recognized for their support of this effort. It is my hope that one result of these hearings might be that the other departments, such as the Department of Interior, will be encouraged to develop the means by which they, too, can join in sharing the short-term costs

of funding Landsat—and perhaps the Department of Agriculture and Energy as well. Such participation would be particularly meaningful to many of my constituents and generally to all the public and private users of Landsat-generated information.

Thank you for this—Mr. Chairman.

Mr. SCHEUER. Thank you, Lamar Smith.

And now the chairman of the House Science, Space and Technology Committee himself, the distinguished Robert Roe, of New Jersey.

Mr. ROE. Thank you, Mr. Chairman, for inviting me. And I don't want to prolong this discussion but I think that the chairman has summed up well, most loquaciously and most forcefully as how Congress feels about this entire issue. I have spoken in depth with the Vice President and I'm going to be meeting with him later this afternoon to go over the modified proposals that are being presented. We do not know at this point how much each one of the agencies will put up towards the 9.4 million, but I can assure everybody we're going to do everything humanly possible to see that this Landsat program goes ahead.

But, I think that the hearings are highly timely based upon the point of view that we've got to stop the damn nonsense and establish national policy on commercialization of anything we're going to be doing as far as satellites are concerned. And the idea—I think we made this comment before. The point that Congress provides only one year of funding is absolutely sheer nonsense as far as the whole aerospace industry is concerned, and this committee has worked vigorously, as you know, to place our authorization and, hopefully, our funding on a 3-year basis.

So having said that, I have confidence today. I think the chairman is making a very strong point. How far this is going to go to provide the entire 9.4 million I don't know, but it would be kind of stupid on our part not to work out some reasonable plan so we can continue on in the level that we're working on now.

I want to thank you after that, Mr. Chairman, for letting me speak a few minutes.

Mr. SCHEUER. I thank the chairman.

Congressman Bob Smith of New Hampshire?

Mr. ROBERT C. SMITH. Mr. Chairman, thank you. I really couldn't put it any better than the chairman of the full committee, Mr. Roe, nor any better than you and my colleague, Lamar Smith of Texas. I certainly agree that the Landsat program should and must go forward and will certainly be supportive of the committee along those lines, and at this point would yield back my time to move on with the proceedings.

Mr. SCHEUER. Thank you very much, Bob.

Congressman John Tanner, of Tennessee, also a very—oh, I'm sorry. I recognize Congressman George Brown, of California, the ranking member of this committee and the maker of the motion, the generous maker of the thoughtful motion to ask unanimous consent at an earlier point in this hearing.

Mr. BROWN. I know you'd do the same for me, Mr. Chairman.

Mr. SCHEUER. Staff says they won't allow any more unanimous consent requests. [Laughter.]

Mr. BROWN. I'll be brief, Mr. Chairman. As you know, you and I and Chairman Roe and a hundred other Members of Congress joined in sending a letter to the President and Vice President Quayle urging them to prevent the shut down of Landsats 4 and 5, and I am encouraged at the progress that they're making.

However, I continue to be extremely concerned about the lack of adequate Federal support for a long range civilian remote sensing program. In 1985, the National Academy of Sciences issued a report called "Remote Sensing of the Earth From Space: A Program in Crisis," which is very reminiscent of the situation today. That document then described the sad state of our land remote sensing program and raised the question why should such a practical program be floundering. It concluded with alarm that the United States is marking time as other countries have moved toward world leadership and prepare to reap the benefits of our investment using technology developed in this country.

Since the issuance of that report nothing has changed. The land remote sensing program is still in crisis. Other nations are moving ahead with our technologies, while we play brinksmanship with the Landsat commercialization effort. And we are still left with the same burning question: Why should such a practical program be floundering?

Over the past few days scientists from around the country have contacted my office to express their utter disbelief that the United States would terminate the operations of Landsats 4 and 5. Other offices, and I know yours has received similar calls, for it's a rare day on Capitol Hill that over a hundred offices will agree to sign a letter on any topic, especially on such short notice.

I hope the Administration realizes the tremendous value of this program. I'm interested in hearing the details of the plan to keep Landsat 4 and 5 in operation, and I commend the chairman for his leadership, both you, Mr. Scheuer, and Chairman Roe, in pressing this thing. But more importantly, I'm eager to hear the plans for the future of the U.S. earth remote sensing program.

The Department of Commerce has just released a report, I might say under a little bit of pressure, that is probably the best that's ever been conducted on the market potential and future options for earth remote sensing. The United States Government should move ahead quickly on the basis of that report to quickly—to provide steady support for a state-of-the-art advanced commercial remote sensing for the 1990s and beyond.

Mr. Chairman, I ask unanimous consent to revise and extend my remarks and to include a copy of the letter to the Vice President signed by over a hundred Members of Congress on this subject.

Mr. SCHEUER. There being no objection, so ordered. And I thank the gentleman for his fine remarks.

[The further statement of Mr. Brown and letter follow:]

Landsats 4 and 5: Funding Issues

Statement by Rep. George E. Brown, Jr.
Hearings of the Subcommittee on
Natural Resources, Agriculture Research and Environment
March 7, 1989

MR. CHAIRMAN, MORE THAN 100 MEMBERS OF CONGRESS JOINED ME TODAY IN SENDING A LETTER TO PRESIDENT BUSH AND VICE PRESIDENT QUAYLE URGING THEM TO PREVENT THE SHUTDOWN OF LANDSATS 4 AND 5 AT THE END OF THIS MONTH. WHILE I AM ENCOURAGED TO READ IN THIS MORNING'S PAPER THAT A PORTION OF THE NECESSARY $9.4 MILLION HAS BEEN RAISED, THUS DELAYING THE SHUTDOWN, I CONTINUE TO BE EXTREMELY CONCERNED ABOUT THE LACK OF A ADEQUATE FEDERAL SUPPORT FOR CIVILIAN REMOTE SENSING.

IN 1985, THE NATIONAL ACADEMY OF SCIENCES ISSUED A REPORT CALLED REMOTE SENSING OF THE EARTH FROM SPACE: A PROGRAM IN CRISIS. THAT DOCUMENT DESCRIBED THE SAD STATE OF OUR LAND REMOTE SENSING PROGRAM, AND RAISED THE QUESTION: "WHY SHOULD SUCH A PRACTICAL PROGRAM BE FLOUNDERING?" IT CONCLUDED WITH ALARM THAT

"THE UNITED STATES IS MARKING TIME AS OTHER COUNTRIES MOVE TOWARD WORLD LEADERSHIP AND PREPARE TO REAP THE BENEFITS OF OUR INVESTMENT--USING TECHNOLOGY DEVELOPED IN THIS COUNTRY!"

SINCE THE ISSUANCE OF THAT REPORT, NOTHING HAS CHANGED. THE LAND REMOTE SENSING PROGRAM IS STILL IN CRISIS. OTHER NATIONS ARE MOVING AHEAD WITH OUR TECHNOLOGIES, WHILE WE PLAY BRINKSMANSHIP WITH THE LANDSAT COMMERCIALIZATION EFFORT. AND WE ARE STILL LEFT WITH THE SAME BURNING QUESTION: WHY SHOULD SUCH A PRACTICAL PROGRAM BE FLOUNDERING?

OVER THE PAST FEW DAYS, SCIENTISTS FROM AROUND THE COUNTRY HAVE CONTACTED MY OFFICE TO EXPRESS THEIR UTTER DISBELIEF THAT THE UNITED STATES WOULD TERMINATE THE OPERATIONS OF LANDSATS 4 AND 5. OTHER OFFICES MUST HAVE RECEIVED SIMILAR CALLS, FOR IT IS A RARE DAY ON CAPITOL HILL THAT 100 OFFICES AGREE TO SIGN A LETTER ON ANY TOPIC, ESPECIALLY ON SUCH SHORT NOTICE.

I HOPE THE ADMINISTRATION REALIZES THE TREMENDOUS VALUE OF OUR CIVILIAN EARTH REMOTE SENSING PROGRAM. I AM INTERESTED IN HEARING THE DETAILS OF THE ADMINISTRATION'S PLAN TO KEEP LANDSATS 4 AND 5 OPERATIONAL FOR AT LEAST A FEW ADDITIONAL MONTHS. MORE IMPORTANTLY, HOWEVER, I AM EAGER TO HEAR THE ADMINISTRATION'S PLANS FOR THE FUTURE OF THE U.S. EARTH REMOTE SENSING PROGRAM.

THE DEPARTMENT OF COMMERCE HAS JUST RELEASED A REPORT THAT IS PROBABLY THE BEST THAT HAS EVER BEEN CONDUCTED ON THE MARKET POTENTIAL AND FUTURE OPTIONS FOR EARTH REMOTE SENSING. THE U.S. GOVERNMENT SHOULD MOVE AHEAD QUICKLY TO PROVIDE STEADY SUPPORT FOR A STATE-OF-THE-ART ADVANCED COMMERCIAL REMOTE SENSING FOR THE 1990S AND BEYOND.

file

Congress of the United States
House of Representatives
Washington, DC 20515

March 7, 1989

President George Bush
The White House
Washington, DC 20500

Dear Mr. President:

We are writing to urge your prompt assistance in helping prevent the shut down of the nation's only operational civilian land remote sensing satellites: Landsat 4 and Landsat 5.

On February 15, the Department of Commerce directed the Earth Observation Satellite Company (EOSAT) to cease operations of Landsat 4 and Landsat 5 as of March 31. The "Landsat Shut Down Plan" began on March 1.

We believe that Landsat has been one of the greatest triumphs of the nation's civilian space effort. The technology for remote sensing was pioneered by the United States, and is now being successfully operated by France, Japan, the Soviet Union, and India--with other nations soon to follow. Although construction is underway on Landsat 6, that satellite will not be launched until June 1991. The Landsat Shut Down Plan would thus cause a two-year break in data collection. This would impair the prospects for successfully commercializing remote sensing technology, and it would be a serious setback for the nation's civilian space program.

We respectfully request that you help develop a plan to find the $9.4 million necessary to keep Landsat 4 and Landsat 5 operational for the remainder of this Fiscal Year. We urge you to convene a meeting to instruct the National Aeronautics and Space Agency and the Departments of Defense, Commerce, Interior, and Agriculture, in conjunction with EOSAT, to mutually agree on a formula that raises the necessary $9.4 million. It would be a tragic mistake if this relatively small amount of money could not be found in order to preserve an enormously important program.

We appreciate your attention to this request.

Sincerely,

Robert A. Roe

George E. Brown, Jr.

James H. Scheuer

Robert S. Walker

Ron Packard

Dave McCurdy

Claudine Schneider

Bill Nelson

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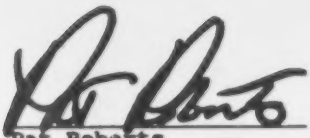
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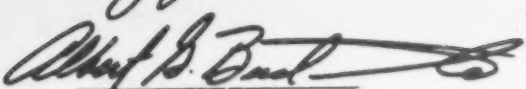
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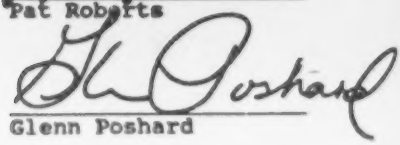
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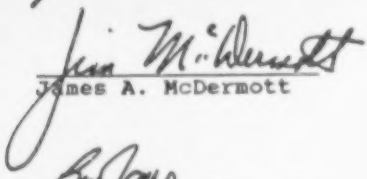
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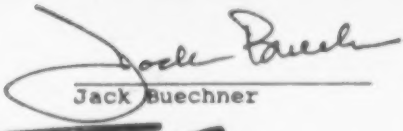
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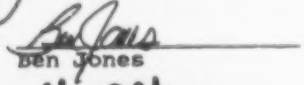
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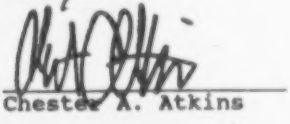
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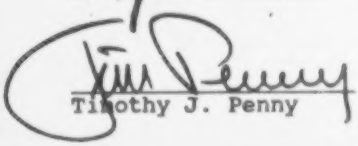
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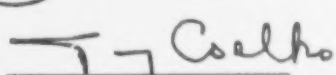
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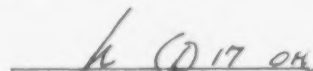
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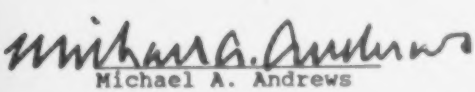
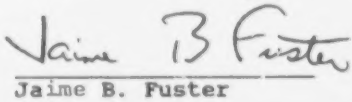

Michael A. Andrews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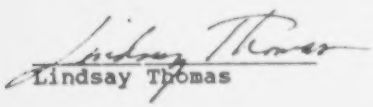
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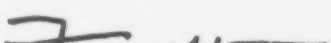
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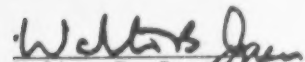
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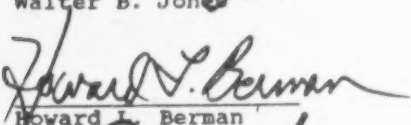
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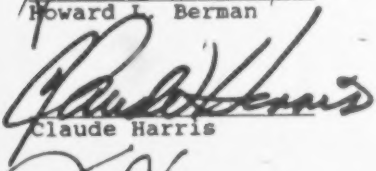
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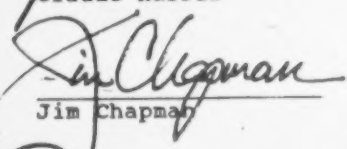
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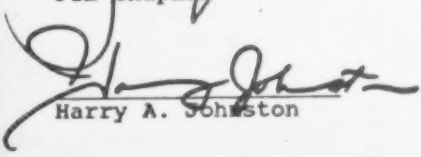
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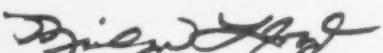
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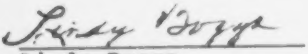
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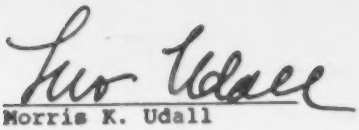
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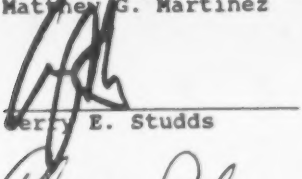
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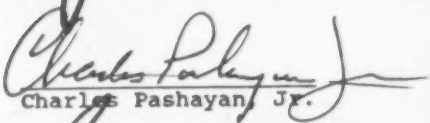
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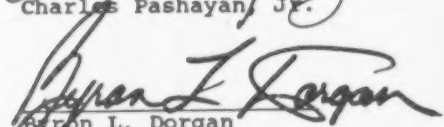
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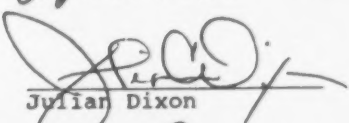
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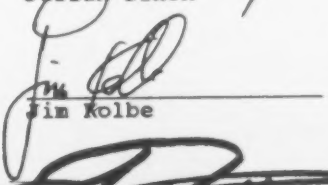
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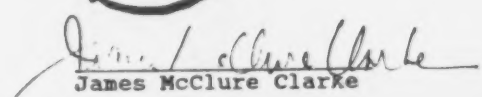
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Jolene Unsoeld

Lane Evans

Peter A. DeFazio

Constance A. Morella

Tim Valentine

Fortney Pete Stark

Marvin Leath

David E. Price

Terry L. Bruce

Robert C. Smith

Joe Moakley

Steny Hoyer

Les AuCoin

James J. Florio

Tom Tauke

George Miller

Bob Whittaker

Lamar Smith

Paul E. Kanjorski

Paul Henry

Benjamin A. Gilman

Thomas C. McMillen

Mr. SCHEUER. Congressman Paul Henry, of Michigan.

Mr. HENRY. Well, thank you, Mr. Chairman. I won't be long, but just to review so we know what we're talking about. We're talking about an instrument which is used for weather forecasting, crop forecasting, mapping, environmental research and science, mineral exploration. It contracts with Government agencies: NASA, potentially EPA, Agriculture, Interior, NOAA; has drug enforcement capacities, defense capacities. No one has mentioned its role in pure science, what we're presently calling the "science of chaos" or looking at patterned anomalies in the ecosystem.

But I think Chairman Roe has touched on the key issue among others here, and it affects so many issues before this committee. I happen to agree very strongly with the Administration that this is an area of potential commercial viability; and, insofar as that is the case, there is a good argument for getting the Government involved, and that has been the standard we've used on any number of joint industrial, scientific Government projects.

The problem is terribly compounded, however, on the so-called level playing field and what the competition is doing, and the problem is we are now forced in a situation of giving up everything we've worked for over the years. And so we have the immediate issue over the next 6–9 months. We have an intermediate issue relative to what after this budget year. But we have a more fundamental issue which speaks to any range of scientific questions, and that is in terms of what's happening in the European Community and the Asian nations where we aren't on a level playing field when it comes to commercial viability.

Thank you, Mr. Chairman.

Mr. SCHEUER. Thank you, Congressman Henry.

This is an emergency hearing on a crisis situation. But you can be sure that when we're over the hump on this and we have some kind of a rational answer to Landsat 4 and 5 we will have a set of hearings that will consider all of those long-term issues that you and Congressman George Brown described.

Incidentally, when you talked about—when you ticked off the list of useful and constructive services and information that Landsat performs you mentioned environment research. Well, it's more than that. As you would know, as all of us know, it really provides global environmental monitoring on a current basis and we can track the conditions that lead to desertification, to deforestation, we can track the health of forests and croplands from the point of view of blight and insects and all kinds of threats to the health of forests and the health of croplands. So, in effect, this is a global environmental monitoring system that provides vital information to our country about our own biota, about the living things, the health of the living things in our own country as well as to countries around the world, and I think that should be part of the record.

All right. Congressman John Tanner, of Tennessee, a junior member of this committee but a very hardworking and diligent one.

Mr. TANNER. Mr. Chairman, as a freshman, I can add little to what has been said by both yourself and Chairman Roe. If I may be so bold or so timid as a freshman, it seems this hearing highlights

some of the things that people in the country wonder about when they see what happens in Washington and how we've come to this place without proper planning. And I'd like to commend you and other members of this committee for this hearing today and, hopefully, for some direction so that these emergency hearings may not be necessary to protect what we all know is a very important service not only to this country but to humanity.

Mr. SCHEUER. Thank you very much, John.

Congressman Dave McCurdy, of Oklahoma, who is one of Congress' real experts on this subject. We're delighted to have you here today, Dave.

Mr. MCCURDY. Thank you, Mr. Chairman.

I ask unanimous consent to have a statement that I have prepared be submitted into the record; and, if I may, Mr. Chairman, I only want to commend you for holding this hearing. I think it is incredibly timely, and it is an absolute shame that we've come to this juncture.

Needless to say, this is absolute folly. We are playing brinksmanship or, as I told Mr. Pyke the other day when he was in the office, a pretty expensive game of chicken, and this is not what we feel is in the best interest of the United States.

The gap that could result if this action did take place would be absolutely critical and I think devastating to the commercialization effort. With the next generation of satellites, it's probable that there will be a gap naturally because the systems themselves may play out over time. But because of good planning and cooperation, those systems have exceeded their original life expectancy and we don't think that the Government or the country or the users should be punished for making something work better than what was originally designed. So we cannot allow this gap to occur.

And you mentioned the important areas that Landsat provides information on. Four and 5 do provide great information in each of those areas, but I think one that the—our foreign competition and our foreign competitors is interested in, especially Japan, is economic intelligence, because that is basically what this can provide in the future. And, as a member of the Intelligence Committee, along with the chairman of the full committee and formerly Mr. Brown, I can tell you that these are areas of concern to us.

Last year, as you recall, I came back from one of the Armed Services meetings in research and development, and Don Latham and I and others had worked and provided some additional funding. Well, we can't do that anymore. No more rabbits pulled out of the hat. The current budget cycle and authorization cycle is such that it's not going to occur. We're not in a position to do that. So the burden lies on the Administration and I think that's why they've been, basically, passing the hat.

I joined with Congressman Brown in his letter to the Vice President. Fortunately, I was able to meet with the Vice President last week, or week before last, on this issue, and, as he has told the chairman and others, he is committed to making this work. And I hope that, perhaps, the foundation of the Space Council will go a long way to providing some of the direction and oversight and some of the necessary understanding within the Administration because we've gone through absolute folly for the last few years on this

issue, and we're completely fed up with it. And I think it's time that it be said and that someone downtown should get—as the chairman so aptly said, gets damned serious about this issue and the whole access to space issue and the commercialization issue.

And, again, I commend the chairman for holding the hearing.

[The prepared statement of Mr. McCurdy follows:]

STATEMENT BY

U.S. Rep. Dave McCurdy
Subcommittee on Natural Resources, Agriculture Research and Environment
March 7, 1989

MR. CHAIRMAN, improbable as it may seem, NOAA has initiated a shutdown of the Landsat remote sensing satellite program for lack of $9.4 million.

If allowed to occur, this action would again place the U.S. in the undesirable position of investing billions to develop a technology only to lose its commercial application to foreign competitors.

Brilliantly established by NASA in the early 1970s, Landsat has been at the forefront of remote sensing technology ever since. Landsat images from space have been critical to agricultural crop analysis, environmental management and map making. Customers within the U.S. government include the Departments of Agriculture, Defense and Interior. Other countries have fully understood the value of remote sensing technology. Satellites are now being successfully operated by France, the Soviet Union, Japan and India.

These countries have made conscious decisions to financially support a commercial satellite program while the country which developed the technology struggles to justify its continued well-being.

Having met with the Vice President last week and heard his

pledge to support continued funding of Landsat, I am gratified to read a newspaper report today indicating that the Administration has identified "some funds" to operate Landsats 4 and 5 beyond March 31.

Mr. Chairman, I submit that we need a stronger commitment from this administration if we are to realize further benefit from Landsat technology. The Reagan Administration rushed Landsat into privatization, made ambitious government commitments then walked away from the deal.

The Landsat system serves as a national asset because it jointly benefits public, national security, and foreign policy interests of the United States. It provides long-term monitoring capabilities for growing U.S. and international studies of earth systems and global change. Finally, Landsat provides the U.S. economy with global resource intelligence necessary to stimulate U.S. technological commercial opportunities at home and abroad.

If NOAA is allowed to prematurely terminate Landsats 4 & 5 after working so successfully with EOSAT to extend their operational life capacity, the United States is not only demonstrating bad faith to the world's ground stations now receiving Landsat data, we are also abandoning a billion-dollar investment at its most critical crossroad.

The Bush Administration must join with the 101st Congress to assure immediate funding for Landsat and develop a plan for its systematic commercialization into the future.

Mr. SCHEUER. I thank the gentleman very much.

And now we'll commence with the witness list, and we'll first hear from Thomas N. Pyke, Jr., Assistant Administrator for Satellite and Information Services of the National Oceanic and Atmospheric Administration.

Welcome back to our committee, Mr. Pyke. You were a very thoughtful and forthcoming witness only days ago and we're delighted to have you. In our private meeting you couldn't have been more helpful and thoughtful. We're delighted to have you here before the committee.

Please take such time as you may need to tell us what the policy of this Administration is on Landsat as a key element in our space program; and more specifically Landsat 4 and 5, what is their future to be.

STATEMENT OF THOMAS N. PYKE, JR., ASSISTANT ADMINISTRATOR FOR SATELLITE AND INFORMATION SERVICES, NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

Mr. PYKE. Mr. Chairman and members of the subcommittee, I appreciate this opportunity to appear before you to discuss current plans for Landsat submarine operations.

With your permission, sir, I would like to have my prepared statement submitted for the record and then to summarize my comments briefly.

Mr. SCHEUER. With no objection, so ordered.

Mr. PYKE. I will summarize for you the status of Landsats 4 and 5 and of our contractual arrangements for operating these satellites.

Under one of the provisions of the Landsat commercialization contract between the Department of Commerce and the Earth Observation Satellite Company, known as EOSAT, EOSAT operates the two current U.S. civil land remote sensing satellites. Both of these satellites were designed to have a 3-year lifetime. Landsat 4 was launched in July 1982 and is now over 3 years beyond its design lifetime. This Landsat 4 was the first of a new generation of Landsat satellites having a thematic mapper and a multispectral scanning system, two very powerful instruments, as well as the ability to communicate at very high data rates through NASA's new Tracking and Data Relay Satellite System, known as TDRSS. During Landsat 4's first year of operation, however, that submarine had several major problems. These problems were significant in the decision to launch Landsat 5 ahead of schedule in March 1984. Landsat 5, which is now 2 years beyond its design lifetime, has had technical problems with its data communications or TDRSS communications links.

As a result of these partial failures of Landsats 4 and 5, Landsat 4 is used for the acquisition of both thematic mapper and multispectral imagery that is relayed through the TDRSS data communications system, while Landsat 5 is used to transmit real-time imagery directly to U.S. and foreign ground stations.

Based on our recent experience with Landsats 4 and 5, including the need to monitor these satellites more carefully due to increasing solar activity, we now expect both satellites to be able to con-

tinue operating in essentially their present state for the next 6 months. However, these satellites are well beyond the end of their design lifetimes and failure of the instruments or other satellite components on board could occur at any time.

From the beginning of our Landsat commercialization contract with EOSAT back in 1985, we have contracted with EOSAT to operate Landsats 4 and 5. NOAA oversees this contract and provides funds to NASA for the use of facilities and support services at Goddard Space Flight Center, including the use of the TDRSS data communication satellites. NOAA also provides funding for Landsat data handling and distribution services provided by the Earth Resource Observation System, or EROS, Data Center, a unit of the U.S. Geological Survey, Department of the Interior.

With the cooperation of EOSAT and the other organizations involved in supporting Landsat operations, the cost of Landsat operations has been reduced significantly this fiscal year. As a result, the $9.4 million in available funds for Landsat operations this year will cover the first 6 months of the fiscal year.

Recognizing that Landsats 4 and 5 are likely to continue operating after the end of March, however, we attempted to make suitable financial arrangements pursuant to the report accompanying the FY 1989 Commerce, Justice, State appropriation bill. We notified those Federal agencies that are major users of Landsat data of the current Landsat operations funding situation, and we requested that they consider providing funds for continued Landsat operations.

We encouraged EOSAT to continue Landsat operations at their own expense. We were informed by EOSAT that EOSAT does not intend to continue operation of Landsats 4 and 5 at their expense, but our discussions with EOSAT are continuing. As part of these discussions, we have asked EOSAT to consider providing partial funding for Landsat operations for the next 6 months. As of now, we have no commitment from EOSAT to provide any partial funding.

Mr. Chairman, I would like to provide the committee the Administration's current position on Landsat. The President remains committed to the coordination of a comprehensive national space policy through the establishment of the National Space Council to be chaired by the Vice President. To that end, the Administration is conducting a policy review of Landsat and, until that review is completed, is committed to operating the Landsat 4 and 5 satellites.

The major agency users of Landsat data and EOSAT are expected to cover the interim operating costs, the details of which are still being worked out. Congress will be informed of the interim financing plan shortly. The outcome of the policy review will also be presented in time for Congressional deliberations.

I wish I had better news for you at this time and that all of the details of the interim funding were already worked out. I thank you for this opportunity to report on the status of Landsat operations, and now, Mr. Chairman, I would be pleased to respond to any questions the committee may have.

[The prepared statement of Mr. Pyke follows:]

TESTIMONY
OF
THOMAS N. PYKE, JR.
ASSISTANT ADMINISTRATOR FOR SATELLITE
AND INFORMATION SERVICES
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
U.S. DEPARTMENT OF COMMERCE

BEFORE THE

SUBCOMMITTEE ON NATURAL RESOURCES, AGRICULTURE
RESEARCH AND ENVIRONMENT
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY

U.S. HOUSE OF REPRESENTATIVES

MARCH 7, 1989

Mr. Chairman and Members of the Subcommittee:

I appreciate this opportunity to appear before you to discuss current plans for Landsat satellite operations. I will summarize for you the status of Landsat 4 and 5 and our contractual arrangements for operating these satellites.

STATUS OF LANDSATS 4 AND 5

Under one of the provisions of the Landsat commercialization contract between the Department of Commerce and the Earth Observation Satellite Company (EOSAT), EOSAT operates the two current U.S. civil land remote sensing satellites, Landsats 4 and 5. These were the two Landsats that were operational at the time the contract with EOSAT was signed in 1985.

Both of these satellites were designed to have three-year lifetimes. Landsat 4 was launched in July 1982, and is now over three years beyond its design lifetime. Landsat 4 was the first

of a new generation of Landsat satellites, having a Thematic Mapper (TM) and a Multispectral Scanner System (MSS) and the ability to communicate at very high data rates through NASA's Tracking and Data Relay Satellite System (TDRSS). During its first year of operation, Landsat 4 had several major problems. Two of the four solar panels failed, and we have had to operate with limited power. Landsat 4 also experienced the early loss of one of the two transmitters used to transmit TM data directly to ground stations throughout the world.

These failures were significant in the decision to launch Landsat 5 ahead of schedule in March 1984. Landsat 5, which is now two years beyond its design lifetime, has had technical problems with its TDRSS communication links. As a result of these partial failures of Landsats 4 and 5, Landsat 4 is used for the acquisition of both TM and MSS imagery that is relayed through the TDRSS system, and Landsat 5 is used to transmit real-time imagery directly to U.S. and foreign ground stations.

Based on our recent experience with Landsats 4 and 5, including the need to monitor the satellites more carefully due to increasing solar activity, we now expect both satellites to be able to continue operating in essentially their present state for the next six months. However, these satellites are well beyond the end of their design lifetime and failure of the instruments or other components on board either spacecraft could occur at any time.

LANDSAT OPERATIONS CONTRACT SUPPORT

From the beginning of our Landsat commercialization contract with EOSAT, in 1985, we have contracted with EOSAT to operate Landsats 4 and 5. NOAA oversees this contract and provides funds to NASA for the use of facilities and support services at Goddard Space Flight Center, including the use of the TDRSS satellites. NOAA also provides funding for Landsat data handling and distribution services provided by the Earth Resource Observation Systems (EROS) Data Center, a unit of the U.S. Geological Survey, Department of the Interior.

With the cooperation of EOSAT and the other organizations involved in supporting Landsat operations, the cost of Landsat operations has been reduced significantly this fiscal year. As a result, the $9.4 million in available funds for Landsat operations this year, which includes $6.4 million in 1989 appropriations and $3 million in carryover, will cover the first six months of the fiscal year, or through March 1, 1989.

Under the provisions of the Landsat commercialization contract, EOSAT has the right to market the data from Landsats 4 and 5. Landsat imagery is sold directly and in conjunction with the EROS Data Center to Government, private sector, and academic users. EOSAT also markets current and archived data internationally. NOAA has acted on behalf of EOSAT to establish formal agreements involving 14 countries which have established Landsat ground stations to receive data directly from Landsats 4

and 5 as the satellites pass overhead. NOAA collects $600,000 per year for each active ground station and transfers these funds to EOSAT.

LANDSAT OPERATIONS FUNDING STATUS

Recognizing that the Landsats 4 and 5 would continue to operate after the end of March, we attempted "to make suitable financial arrangements" pursuant to the report accompanying the 1989 Commerce, Justice, State Appropriation bill. We notified those Federal agencies that are major users of Landsat data of the current Landsat operations funding situation, and requested that they consider providing funds for continued Landsat operations. We have made this request of the Departments of Defense, Agriculture, and Interior, and NASA.

We encouraged EOSAT to continue Landsat operations at their own expense. We offered to provide to EOSAT the Government-furnished equipment under the contract and the operating rights to the satellites. NOAA also offered to continue the interface to the foreign ground stations on EOSAT's behalf for the assessment and collection of access and distribution fees. We were informed by EOSAT on February 16 that EOSAT does not intend to continue operation of Landsat 4 and 5 at its expense, but discussions are continuing. As part of that discussion, we have asked EOSAT to consider providing partial funding for Landsat operations for the next six months.

The Administration's position is as follows:

The President remains committed to the coordination of a comprehensive national space policy, through the establishment of the National Space Council, to be chaired by the Vice-President. To that end, the Administration is conducting a policy review of Landsat and, until that review is completed, is committed to operating the Landsat 4 and 5 satellites.

The major agency users of Landsat data and EOSAT are expected to cover the interim operating costs, the details of which are still being worked out. Congress will informed of the interim financing plan shortly. The outcome of the policy review will also be presented in time for Congressional deliberations.

CONCLUSION

I wish I had better news for you at this time. Thank you for this opportunity to report on the status of Landsat operations.

Mr. SCHEUER. Well, you mentioned that EOSAT was unwilling to commit at this time for any future funding. Can you tell us where the likely sources of such funding will be? Defense Department? NOAA? Where?

Mr. PYKE. Mr. Chairman, as I mentioned, we have appealed to those Federal agencies that make extensive use of data from Landsats 4 and 5. These agencies include the Department of Defense, Department of Agriculture, Department of the Interior, and NASA. We have also continued our discussions with EOSAT and, as I mentioned earlier, it is as of this point that we have not yet obtained a commitment from EOSAT to provide partial funding on their part to continue these operations.

Mr. SCHEUER. Have you gotten a commitment from anybody else that would take the funding beyond the 30th or 31st of this month? Do you any commitments in hand?

Mr. PYKE. The story is still unfolding at this moment, Mr. Chairman, but under the auspices of the Vice President's office and the Office of Management and Budget progress is being made to put together a funding package that will provide a substantial part of the funding to continue Landsat operations. We still, however, believe that funding on the part of EOSAT would be an essential part of that funding package to be able to continue the operations for the 6-month period.

Mr. SCHEUER. We have had emanations from EOSAT and they tell us that the government has been a very unstable and unreliable partner. That the government has reneged on its commitments time and after, and they feel that—they don't have confidence in government and they're looking for commitments from government. Any possibility that they as well as we will get some hard answers from you today on where these funds are coming from? We're within a week or two. We're within 2 weeks of those lights being turned out.

Mr. PYKE. The story of Landsat is, in fact, a long and difficult one, especially with regard to funding. However, as I stated——

Mr. SCHEUER. Well, let me just repeat. EOSAT says that the government has reneged time after time on its commitment to fund and to move ahead with the program. That's one of the reasons that Landsat 6 won't be operational until 1991. That's the reason that we have this 2-year dark hole facing us.

Mr. PYKE. Yes, Mr. Chairman, obtaining adequate funding to continue the Landsat program has again and again been a problem. At this time, as I have stated, the Administration will shortly be in a position to inform the committee of the funding package——

Mr. SCHEUER. How soon is shortly?

Mr. PYKE [continuing]. That we will be able to put together.

Mr. SCHEUER. How soon is shortly?

Mr. PYKE. I do not know, sir. But I certainly would expect it to be forwarded to the committee in plenty of time to avoid the end-of-month shutdown with which we had been threatened.

Mr. SCHEUER. Which is like 2 weeks away?

Mr. PYKE. Yes, sir.

Mr. SCHEUER. Okay. I'd like to yield at this time, out of order, to the distinguished chairman of the full committee, Congressman Bob Roe, of New Jersey.

Mr. ROE. Thank you, Mr. Chairman.

I think we ought to get on the record a couple of issues. Has the Administration or NOAA any contingency—let me call that back.

You made a number of statements which the committee is aware of. One, of course, with both 4 and 5 up there, each one has, as you've indicated in your testimony, slight problems existing. However, as a package they are very capable how do you compare them in quality and integrity against the French SPOT satellite as far as information gathering? Is the French a better unit, more quality? What would you say—what would be your opinion there?

Mr. PYKE. First of all, Mr. Roe, in my opinion, the two satellites together, Landsats 4 and 5 together constitute one complete satellite in terms of U.S. Landsat capability.

Mr. ROE. But doesn't it add some unique characteristics, could you tell us that?

Mr. PYKE. Yes, sir. It has some unique characteristics with regard to its multispectral remote sensing capability, the ability to remote sense at multiple points in the spectrum on a continuous basis; and, although it does not have quite as high resolution as the French SPOT satellite, this multispectral capability makes it very valuable for many applications.

Mr. SCHEUER. With the chairman's indulgence—could you translate, in intelligible language for members and for the public, what this multispectral capability really means—in the King's English, or rather in the Queen's English?

Mr. PYKE. Yes, Mr. Chairman. The multispectral capability means that the satellite at any given point in time is taking pictures at various points in both the visible and the infrared spectrum, frequency spectrum. That is, for example, it's looking at green, and it's looking at red, and it's looking at colors that we can't see with our naked eye, and it's doing that concurrently in a way that brings us back very valuable information, not just a black-and-white picture, so to speak, of the earth, but a picture that's multidimensional in that it has these multiple wavelengths represented in the data being returned to us.

Mr. SCHEUER. Please continue.

Mr. ROE. Therefore—you still didn't quite answer the question. In your judgment, from your professional position and your technological background, is the—our 4 and 5 as a unit more effective? Is it better than the SPOT?

You said resolution. I know the SPOT has better resolution. I want to get the rest on the record.

Mr. PYKE. For many applications, our Landsats 4 and 5 are superior to the SPOT satellite.

Mr. ROE. That's what I wanted to get on the record.

Let me ask you the second question. It's reasonable to believe that the—both 4 and 5 will not go out at one time. That's a reasonable assumption I would assume. Well they could. That's a reasonable assumption clearly.

What—suppose either 4 or 5 goes out. Then how do you see that comparison? In other words, you know, what if one literally out, it's no longer functional.

Mr. PYKE. Well, we would certainly be missing a major portion of our capability. It depends on exactly what failed and exactly what was left working, but we would still have a capability to sense with both types of instruments. Presumably, whichever satellite went out it would in large part be a question of how readily we could get that data back down to earth, whether we could relay the large amounts of data back through the high data rate, TDRSS data communications system or whether we could only communicate directly to the ground systems.

Mr. ROE. Let me ask you the next question. The next question would be what has the Administration and/or NOAA, who is the operator I understand, what kind of contingency plans have you made? Let's suppose that there was funding and blah, blah, blah and the whole bit. What contingency plans have we made, if any, if we have a failure?

Mr. PYKE. Mr. Chairman, Landsats 4 and 5 are a part of a series of satellites leading to Landsat 6——

Mr. ROE. That I understand.

Mr. PYKE [continuing]. Which is the next satellite——

Mr. ROE. If the gentleman would yield, I understand the full background on this including 6 and everything else we're at. In other words, we're depending on 4 and 5 at this point.

Mr. PYKE. Yes, sir.

Mr. ROE. My question is, and you've already testified—the chairman, himself, has mentioned from what I understand—that we can't put up number 6 until 1991, I believe it is.

Mr. PYKE. That's correct.

Mr. ROE. Now, therefore, if we have a failure between now and 1991, and if all of this use is of such import—and we want to ask certain agencies certain things in due course—and we have a failure of part or in whole in between now and 1991, is there any contingency that the Administration and/or your Department has to fill that need?

Mr. PYKE. The backup in that case, sir, will be either to provide access to the archival Landsat data, which, based on last year's testimony from EOSAT, would constitute a substantial revenue in terms of their projected sales volume as of that date——

Mr. ROE. How much? One-third?

Mr. PYKE. Last year, I recall that they testified—Mr. Norris of EOSAT testified that that they expected to have revenues of up to $10 million per year in terms of sales of the archived Landsat data.

But, in addition to the access to the archived Landsat data we would also have available to us and in some cases be forced to rely on access to the French SPOT system.

Mr. ROE. Well, we would have no real-time information. In other words, if we've shut down, we're just not going to have any real-time information. That's about a third of the revenues, as I understand it. Huh?

Mr. PYKE. Yes, sir. We would no longer have a U.S. civil land remote sensing system in operation at that time.

Mr. ROE. All right. And that includes our international customers too. They wouldn't be able to receive any data other than archival data, right, basically?

Mr. PYKE. Yes, sir, except from the French SPOT.

Mr. ROE. All right. Now, for the benefit of the committee, let me ask you just one other question. Mr. Chairman, I'm almost done.

It seems to me to be fundamental of 2 points from a financial point of view. If we shut the thing down at this point we lose the revenues, obviously. And, in addition to that, if the Landsat-type of data is as important as everybody is testifying that it is, that means that we have to purchase data from somebody else. Is that reasonable?

Mr. PYKE. Yes, sir.

Mr. ROE. So, therefore, fundamentally, from a purely financial, sound economic point of view, that if we allow the 4 and 5 to be shut down and we go out of the business, we not only lose the revenues derived, but we also would be spending considerable additional funding to secure this information from the French, the only ones I believe now who are capable. Is that reasonable? Soviets? Or the Soviets?

Mr. PYKE. To the extent that we continued purchasing data during that interim period before Landsat 6, yes, we would be spending, perhaps, more money to purchase from SPOT and, to the extent available, from——

Mr. ROE. The Soviet Union.

Mr. PYKE [continuing.] The Soviets. But, in some cases it may just be that the various users would choose to do without that data on an interim basis, or do without the current data on an interim basis while awaiting Landsat 6.

Mr. ROE. Well, don't we—Mr. Chairman, one more, then I'm finished. Don't we have to establish here today, which I'd like to see established in this hearing, is just how important is the Landsat data? I, too, am getting 9 million letters and telegrams and everything else. How important is it to the country? Is it a commercially viable venture? Is that why the French are in it or that's why the Soviets are in it?

So, therefore, we would lose real up front money, cost us additional funding and so forth simply by not going ahead. That's I think what we have before us, and those are the questions that I would like to ask the agencies involved. How important—how important is it to DOD? How important it is to agriculture? Can we get along without it? Can we just draw the archival data? What should we be doing?

Thank you, Mr. Chairman.

Mr. SCHEUER. Thank you, Mr. Chairman.

I now call on Congressman Tim Valentine, of North Carolina.

Mr. VALENTINE. Thank you, Mr. Chairman. I, maybe what I'm going to ask has already been answered, so I apologize.

Do I understand it, Mr. Pyke, that the Landsats have outlived their life expectancy and in that sense are paid for?

Mr. PYKE. Mr. Valentine, the 2 Landsats—Landsats 4 and 5—have outlived the lifetime that they were originally designed for. They're living on borrowed time, if you like, at this point in time,

and, although they're both disabled, they do both continue to operate.

Mr. VALENTINE. Um-hum. So they, they have been depreciated out, so to speak, if you're going to make some kind of record for tax purposes and in that sense they're now free, aren't they?

Mr. PYKE. In one sense, sir, we are living on bonus time, sir.

Mr. VALENTINE. Yes. Better than free.

Mr. PYKE. So, for example, sir, the revenues now being collected by EOSAT represent a bonus, based on anything they might have expected just a few years ago.

Mr. VALENTINE. Yes. And you've just testified, as I understood it, that we needed the information. Well, why don't we—why don't we get it from free stuff? I mean, why do we want to go turn off something that's there that's paid for that's shooting back information that we need? Explain that to me. I don't have a background in this sort of thing.

Mr. PYKE. Mr. Valentine, the basic spacecraft themselves were long ago paid for, and, of course, as was the launch for each of them, but there is a continuing cost for operations of these satellites and that's what we're discussing here today. It cost an estimated $9.4 million to operate these satellites for a 6-month period.

Mr. VALENTINE. Well, is the operation cost—excuse me. I don't mean to interrupt you. But isn't the operating cost much less than purchasing the material from some other source?

Mr. PYKE. The operating cost is large compared to some other expenses. It depends on the other sources and it depends on how much data is purchased as to whether that $9.4 million is large compared to what might be spent on alternative sources.

Mr. ROE. Would the gentleman yield?

Mr. VALENTINE. Yes. I yield, Mr. Chairman.

Mr. ROE. I think it would be very appropriate to get on the record at this time, to get on the record at this time what is the capital estimated cost for Landsat 6, to build and launch Landsat 6?

Mr. PYKE. Mr. Roe, the total capital cost for Landsat 6, as represented in our contract with EOSAT, and for the launch of Landsat 6, which will be covered at government expense, is approximately $256 million.

Mr. ROE. So, from a capital point of view, to replace 4 and 5 with 6 it's going to cost us 200 and how much?

Mr. PYKE. $256 million.

Mr. ROE. $256 million, for the record. That's the capital cost.

How much was the capital cost for 4 and 5, do you know that offhand?

Mr. PYKE. I do not know, sir, but I believe it was on the order of—[pause]—on the order of $500 million for both satellites.

Mr. ROE. I thank the gentleman for yielding.

Mr. SCHEUER. It is true——

Mr. VALENTINE. Excuse me.

Mr. SCHEUER [continuing]. With your indulgence—that our total investment in the Landsat program now to get us up there, get that capability and to develop a marketing program, a successful marketing program all around the world is a billion and a half dollars. That's what it cost us to get up there with a successful pres-

ence both for all of our government agencies and a commercial presence that industry, agriculture and what not value very highly. Right? Billion and a half dollars to get into business, to get that stream of information flowing from which we derive considerable revenue; right?

And the presumption is that if we make this disastrous aberrational decision to close it down voluntarily, abdicate the market, abandon it, shoot ourselves in the foot, we're doing this to save $9.5 million a year for a year or two, in effect, irreparably damaging our capacity and our credibility in being a major player. A privilege for which we paid a billion and a half dollars. Does that make economic sense? Is that the message we want to send to the rest of the world?

Mr. BROWN. Mr. Chairman, I have to object that the chairman is leading the witness. [Laughter.]

Mr. PYKE. Mr. Chairman, I am pleased to have reported to you earlier that the Administration is committed to continuing the operations of Landsat 4 and 5 and to finding a way to do so, while at the same time undertaking a major policy review of the entire Landsat program.

Mr. SCHEUER. You know, the major policy review ought to wait, really, until we get over this hump. You're going to have to give notice. You're going to have to give notice of dismissal, do you—will you not, by the 15th of this month to a large number of employees in your agency? They have to—and EOSAT? If we're going to close off by the end of this month, we have to give them 2 weeks' notice. That means by the middle of the month we have to get those notices of dismissal out.

It seems to me that with that point in time only days away you ought to be able to tell us and these poor beknighted, beleaguered employees something more than that you're canvassing the agencies. We know you've been canvassing the agencies. Telephone lines have been working overtime. The phones have been ringing off the wall with people calling in to us telling us about the conversations, the meetings, the phone calls that are taking place.

You can't give us a single list today, a list today of the agencies that would be willing to carry on this program at least until you have the time to get your act together and finally come up with a long-term satellite imaging public policy; is that correct?

Mr. PYKE. Mr. Chairman, let me clarify my earlier remarks, if I may. The Administration is committed to conducting a thorough policy review of Landsat and, until that review is completed, the Administration is committed to assuring that Landsats 4 and 5 will continue in operation.

As a part of the funding package——

Mr. SCHEUER. How much money are you going to put together? Who are the actors? Which government agencies want to contribute? And how long will that funding last? Will it give us time to get a supplemental appropriation through?

These are questions that I, frankly, had hoped that the Administration would have some answers to today. They haven't. I don't want to belabor the point any longer, and I apologize to my colleague, Tim Valentine——

Mr. MCCURDY. Let him answer the question.

Mr. SCHEUER. And I return—and I return the——

Mr. VALENTINE. Thank you, Mr. Chairman. I just want to ask one or two other questions. I thought my time was gone. I appreciate your sending it back to me. [Laughter.]

But, Mr. Pyke, let's assume that you were, that you were chief executive officer of Lone Star—no, let's say Coastal Carolina, an information gathering service, and you had a machine of this kind which was in operation, was paid for, was sending back information which was useful to you and which you could sell, and you had the ability to press a button and shut it off, so you could go and buy that same information somewhere else and pay more money for it, how would you—how would you explain that decision to your board of directors?

Mr. PYKE. Mr. Chairman, I'd—Mr. Valentine, I would very carefully weigh the alternatives and the costs and take a look in the pocketbook of the company, see whether we could afford any of the alternatives in front of us——

Mr. VALENTINE. But, Mr. Pyke, wouldn't you know already that—I mean, the machine is paid for. What you're getting you know and you don't have to pay as much for it as you would to go out and pay someone else to deliver it to you. I mean, isn't that elementary?

Mr. PYKE. Yes, sir. The question here today is not the paid for cost for the satellites or even the cost for Landsat 6 for which we're prepared to pay—to continue providing the funding. The question is these operating costs which albeit are small compared to the capital investment.

Mr. VALENTINE. Well, aren't they small compared to the cost of purchasing this material from overseas?

Mr. PYKE. That's not clear, sir. It depends on the amount of data that's purchased both from archives as well as from alternative sources.

Mr. VALENTINE. All right, sir. Thank you.

Mr. SCHEUER. Congressman David Price, of North Carolina.

Mr. PRICE. Thank you, Mr. Chairman.

Mr. Pyke, can you enlighten us further as to the nature of this Space Council review of the Landsat program, particularly the implications of that review for attempts at Landsat commercialization? What is the status of this review? It's not clear to me either why this particular decision must await that larger scale review. But, perhaps, if I understood more about the review that would become clear.

Mr. PYKE. Mr. Price, this decision will not await the result of that review. The decision to commit to continued funding for Landsats 4 and 5 in an appropriate manner that includes funding from Federal user agencies as well as from EOSAT has already been made. The commitment has been—and, as I stated earlier, the commitment has been to assure that these satellites will be operated at least until the results of a comprehensive policy review of the Landsat program are completed, at which time decisions and recommendations will be made concerning the future of these satellites should they still be alive and well at that time.

Mr. PRICE. What is the nature of that review, though? What—why are these two matters linked together even to that degree?

Mr. PYKE. It's my understanding, sir, that the review will be comprehensive in nature and will explore all possible options for the future of the Landsat program, taking into account the requirements for Landsat data from the Landsat satellites and alternative financing mechanisms for not only operating existing submarines but for funding the development of future submarines.

Mr. PRICE. The timetable for Landsat 6 now is what?

Mr. PYKE. Landsat 6 is on schedule at this time for a 1991 launch.

Mr. PRICE. And that's on track? That's a fairly firm date?

Mr. PYKE. Yes, sir.

Mr. PRICE. What is the EOSAT's relation to this? You say that they do have the option of continuing this service even if the agencies don't pick up funding?

Mr. PYKE. EOSAT is our Landsat commercialization contractor.

Mr. PRICE. Yes.

Mr. PYKE. We contract with them, for example, for the development of Landsat 6, and through them to their subcontractors GE and Hughes, GM-Hughes, who also happen to be the owners of EOSAT. We also contract with EOSAT for the operations of these satellites, and as a part of the package—a part of the contract we have made available the rights to all of the data from Landsats 4 and 5 which they in turn sell. They sell the data, sir, not—as a result of having those rights. They collect the revenues from the sale of that data and cover a portion of their operating and marketing expenses from those revenues.

It is our belief and understanding that at this point in this long-term process on this contract that, although the government strictly under the terms of the contract is to provide the funds for operations of Landsats 4 and 5, it is our belief that the time has come for EOSAT to begin sharing a part of the burden of the cost of operating these satellites which through their very operation result in substantial revenues coming into EOSAT.

Mr. PRICE. Can you clarify, though? What is the nature of the proposition you made to EOSAT that they rejected? And then what kind of possibilities, alternative possibilities are now under active consideration?

Mr. PYKE. The first possibility we proposed was when we, NOAA, were faced with a situation that we had no funds to operate these satellites beyond the end of March. At that time, rather than just turn these satellites off, we offered EOSAT the opportunity to pick up the entire continuing operating expenses for the satellites.

Mr. PRICE. And that was refused.

Mr. PYKE. That was the first request and they indicated that they were not interested, not willing to pick up the expenses of operating the satellites.

The second request we made of them has been, since it has been evident that we would be able to obtain a significant part of the necessary funding for the next 6 months through contributions from other Federal agencies, since that intent became clear to us we have then gone back to EOSAT and we have asked them to consider covering the remainder of the cost of operating these submarines over the next 6 months. And, as of this point in time, we do

not have a commitment from EOSAT to provide any portion of the continued funding for operations of the satellites.

Mr. PRICE. So EOSAT's response is still unclear and the exact agency commitments are also unclear; is that true?

Mr. PYKE. The entire funding package with regard to the interim financing plan with contributions from the Federal Landsat data-using agencies will be provided to the Congress shortly. It is still being developed at this time.

Mr. PRICE. Finally, back to the question of commercialization. Does EOSAT's response and the calculations that have gone into that, does that have implications in terms of the long-term prospects for commercialization?

Mr. PYKE. I would think, Mr. Price, that it would be opportune for EOSAT to considering putting some of their own money into the operations of Landsat 4 and 5, not only to assure continued revenues over this 6-month period, but also to assure that there will be a U.S. presence, or to help to assure that there will be a continued U.S. presence in civil land remote sensing which will give them a better edge when it comes to marketing Landsat 6 data in 1991.

Mr. PRICE. How do you explain their failure to see it that way?

Mr. PYKE. Mr. Price, we do not yet have a failure on their part to see it that way. At this point we——

Mr. PRICE. Well, your first proposition was turned down.

Mr. PYKE. At this point we don't have a proposition that was turned down. At this point we simply do not have a commitment from EOSAT that they would be willing to provide a portion of the funding.

Mr. PRICE. Thank you, Mr. Chairman.

Mr. SCHEUER. Thank you, Congressman.

Congressman Paul Henry, of Michigan.

Mr. HENRY. Well, thank you, Mr. Chairman.

I think the gentleman from North Carolina, Mr. Price, was getting to the nub of the issue, quite frankly. None of us want to see the Landsats 4 or 5 shut down. We all realize that would be kind of a stupid thing to do.

But what this really represents, in part, I take it, is a contract negotiation between the Federal Government and Hughes and RCA and EOSAT. The issue is not any kind of capital cost recovery on Landsat 4 and 5. That's done. The data base and archives were turned over to EOSAT. EOSAT sells, as a contractor, the data base, current imaging and services to government agencies or private market purchasers of that data.

How much—what was the gross income of EOSAT the last year that you got records for?

Mr. PYKE. Mr. Henry, although that information has been provided to us, it is considered proprietary under the terms of the contract, and I suggest that you consider asking that question of the EOSAT official who will be testifying later today.

Mr. HENRY. So EOSAT's making somewhere between $1 and a hundred million dollars a year proprietary, okay. And I'm not—I'm being silly because I know it's not near the upper figure. But——

Mr. PYKE. We have reason to believe, sir, that their revenues are sufficient that it would be in their best interest to kick into the pot to help pay for continued operation of Landsat 4 and 5.

Mr. HENRY. In other words, EOSAT is making somewhere in gross revenues $18 to $30 million a year, and the question is out of that whether or not it is then—since that's a revenue stream based on a capital gift to them to establish the commercial policy, whether it's legitimate to ask them to share or participate in the cost of the continuation of the service. That's really what's at issue here, isn't it?

Mr. PYKE. Mr. Henry, again I'd prefer not to comment on the information that's been given to us as proprietary information. However, as of this point in time, had we been on our original schedule for—in the Landsat commercialization enterprise Landsat 6 would have been launched this year——

Mr. HENRY. And that gets me now to the next point.

Mr. PYKE. And for Landsat 6, Mr. Henry, EOSAT under the contract is required to pay the entire cost of operations. So EOSAT——

Mr. HENRY. Right. And that gets you next that the delays, the delays in Landsat 6, in turn, get the private investors or venturers, as you were, in a different position of wondering how much they want to put in, how much they ought to put in given some of the lack of certitude they have had on the scheduling and getting 6 up and running under a contractual agreement? Whether you agree with the contractor or not, that's their concern, and what's happening is they're all getting moved together here. Is that a fair assessment?

Mr. PYKE. Well, fortunately, Mr. Henry, we have had a, what I called earlier a bonus period of operation of Landsats 4 and 5 and with revenues being collected by EOSAT at an appropriate level, and we're now—and it has continued up to that point in time, from the beginning of this contract up to this point in time which was the point in time at which EOSAT had agreed to start covering the entire operations cost for the next satellites.

Mr. HENRY. If the whole thing closed down today for some reason, Landsat 4 and 5 fell out of the sky or didn't work, EOSAT would have made money; is that a correct assumption?

Mr. PYKE. That would be my understanding, sir. I suggest you ask that question of EOSAT when they testify later.

Mr. HENRY. Okay. Thank you. Thank you, Mr. Chairman.

Mr. SCHEUER. Mr. Pyke, I don't want you to feel that any of us here are badgering you or otherwise harassing you. You're on the hot spot through no doing of your own. We have always found you a very cooperative and a thoughtful leader in the executive branch to work with, and we've enjoyed working with you.

Having said that, can I ask you—[Laughter.]

Does the Administration plan to request a supplemental appropriation for fiscal '89 as a part of your plan—of the plan that seems to be under development, we hope, to rescue Landsat 4 and 5? Will we get a timely request for a supplemental appropriation?

Mr. PYKE. Mr. Chairman, you will get a timely financing plan that will cover the operations of Landsat 4 and 5 to the extent that we believe the Federal Government should provide funding or is

able to provide funding for the 6-month period, and that funding is expected to come in large part through contributions made by the Federal agencies that are extensive users of Landsat data. As to the details of the mechanics of how those funds will be made available, and as to whether a supplemental or some other means might be necessary in order to assist in making those funds available to use for this effort, I am not in a position to address those details at this time.

Mr. SCHEUER. Well, you know they say God is in the details. Two questions. What's going to happen between now and the end of the fiscal year, and that would require a supplemental appropriation? And then what's going to happen in fiscal year 1990 where this budget provides no funding request whatsoever for Landsat 4 and 5? As part of this overall plan—I should amend my question and say, are you going to give us a request for a supplemental appropriation to tide us over till the end of this fiscal year, and then are you going to change your budget for 1990 to provide a funding request for Landsat 4 and 5 to continue their operations in 1990 if the gods shine on us and they continue this unexpected dividend of being operational long after their expected demise from natural causes?

And I want to emphasize that this is a victory, a success that we've achieved, that American science and technology know-how has achieved. We're not in this situation because of a failure, we're in it because of a success. And the question is are we going to seize victory from the jaws of defeat or are we going to seize defeat from the jaws of victory? We can lessen the damage caused by the Administration's delay over a long period of years in getting Landsat 6 operational. We can lessen the damage and reduce that gap.

So my question to you is are we going to ask for a supplemental, and are you going to change your budget request for 1990?

Mr. PYKE. Mr. Chairman, there is some good news here. Shortly, you will be receiving an interim financing plan. It will be made available to the Congress in plenty of time to assure that Landsats 4 and 5 will not be turned off at the end of March.

Mr. SCHEUER. How about——

Mr. PYKE. The financing plan——

Mr. SCHEUER. How about October 1st?

Mr. PYKE. The financing plan will provide a basis to assure that Landsats 4 and 5 will continue in operation at least until the comprehensive review of the entire Landsat program is completed under the auspices of the new National Space Council. At that time decisions and recommendations will be made, and I'm sure there will be interaction with the Congress, to determine what the future of the Landsat program will be at that time including revisiting the issue of the necessity for funding for Landsats 4 and 5 should they still be alive later on this year.

Mr. SCHEUER. And perhaps next year. There's at least an outside hope that they will remain operational through 1991 when Landsat 6 will come into play and rescue us from what could reasonably have been predicted as the terrible cost of this Administration indecision, and the last Administration's indecision.

Okay. Mr. Pyke——

Mr. SHAYS. Mr. Chairman?

Mr. SCHEUER [continuing]. We enjoyed having you back here——

Mr. SHAYS. Mr. Chairman, please.

Mr. SCHEUER. Oh, I'm sorry. Chris Shays? By all means, Chris Shays, of Connecticut.

Mr. SHAYS. Thank you, Mr. Pyke. I'm not trying to make your life more miserable because, frankly, I think you've done well to defend a very indefensible position. [Laughter.]

And I will say that, you know, I hear a lot of conversation about, you know, the Administration, the Administration, but I kind of felt when I was elected to this process that we were all in this together. It's regrettable that the former Administration didn't request the funds. It's laudable that Congress did. But Congress only funded it for 6 months.

So one of my questions, regrettably, is why did Congress only choose to fund it 6 months? So we have a role to play in that. I already know the answer to that. We didn't choose to and so we have to share some of that burden.

But, Mr. Chairman, what I would really like to do eventually is—to get to the real question, is, if EOSAT is getting a constant stream of revenue, why aren't they contributing to some of the cost? And I would really love it if somehow we're able to get to them pretty soon because that to me is really one of the key questions.

I don't think any of us in this committee need to be convinced of the value of the system. I think most in the Science, Space and Technology Committee under the able leadership of our chairman wanted full funding, and I know the Appropriations Committee chose not to. So it seems to me the case is there to fund it, and I'd just like to know why they can't contribute some of the money. And that's really my interest.

Thank you, Mr. Chairman.

Mr. SCHEUER. Thank you, Congressman. We have two more Members of Congress to recognize. I apologize to George Brown for having inadvertently omitted him in the normal order of Congressmen.

Congressman Brown?

Mr. BROWN. Mr. Chairman, in order that we can get to some of these other witnesses, I will waive my questions at this point.

Mr. SCHEUER. All right. Congressman Tom McMillen?

Mr. MCMILLEN. Mr. Chairman, I presume you didn't see me because I was sitting down over here. [Laughter.]

It's a real pleasure, Mr. Chairman, and thank you. And I appreciate the chance to ask Mr. Pyke some questions. I have some serious concerns—given that Landsat's operation is in Lanham, nearby in my district and several of my constituents work there—that of the government is walking away from a significant investment and also about the cost of restarting this capability has been mentioned here. But, more importantly, I think they are changing the rules in the middle of the game.

As I understand it, the EOSAT's agreement has been to invest an additional $10.8 million in the Landsat 6 system hardware. This was a contract that was signed in anticipation of the government's continued performance of its Landsat 4 and 5 funding operations. If the government now terminates its contractual support for Landsat

4 and 5, does it make sense that, you know, maybe that deal needs to be renegotiated or, more importantly, when we look at the $2.5 million payment due in March, the 31st, would it make sense that you advocate a reprogramming of that payment to support—the reprogramming of that payment for Landsat 6 to continue to support Landsat 4 and 5?

Mr. PYKE. Mr. McMillen, if I may, I'd like to correct or update your understanding of the negotiations that we undertook with EOSAT—we, the government, undertook with EOSAT last year that led successfully to the restart of the development Landsat 6 satellite. During those discussions we were trying to come up with a way to meet EOSAT's estimate for what it would cost to complete Landsat 6, and we didn't see our way clear to come up with a total package and we came up with a total package in which the government would be able to cover all of the costs that EOSAT felt would be met in developing Landsat 6. And what we came up with was a rather creative package between EOSAT and us in which we would, in effect, advance EOSAT a portion of the cost and they would reimburse the government that advancement of $10.8 million by paying us back up to $2.5 million a year—in fact, the first $2.5 million a year of net profits, every year until they had paid back that $10.8 million.

We took the risk—we, the government, took the risk as to whether Landsats 4 or 5 would be operating under any circumstances. We took a risk as to whether Landsat 6 would be successfully launched and successfully brought into operation on orbit. We took a risk that EOSAT's revenues would be sufficient to cover the payback of that $10.8 million.

As I recall, at no time during those discussions and during the negotiations that led to that agreement for the continued development of Landsat 6 was there any contingency of the package for the continued development of Landsat 6 relative to continued funding for the operations of Landsat 4 and 5. Rather, they were separate issues, and the funding issue associated with Landsat 4 and 5 was not on the table. In fact, on April 1 of last year when that renegotiated contract was signed, when the amendment was signed, at that point in time there wasn't even a proposal on the table to provide any funding for Landsats 4 or 5 for this fiscal year at all.

Mr. MCMILLEN. Let me interject there——

Mr. ROE. Will the gentleman yield?

Mr. MCMILLEN. Yes, sir.

Mr. ROE. That is yes and no. That may have been from the Administration's point of view. But having negotiated that entire detail, it was the express concerned and the absolute understanding from the Congress of the United States in both houses that we were going to continue the program. That's how we were able to get number 6 approved and why we deferred 7 on the basis of improved technology, and so forth.

So where Congress is coming from—and I do agree with what the chairman brought out, if the gentlemen will yield further, that the other 6 months of funding, it is not that this committee didn't put its full weight and every effort behind it. It's the fact the Appropriations Committee said, Hey, we'll give you the 6 months and

we'll deal with it when the time is at hand. And now the time is at hand.

But there isn't any doubt whatever that as far as the Congress is concerned that the Congress' full support and full weight has been behind the Landsat program. That's a matter of fact.

Mr. McMillen. The gentleman made the point that the, you know, you're recounting some history here and there has been 19 modifications in this contract since 1985. So I admire your ability to keep all of that straight.

But the bottom line on this, as I understand it, was that this was based on the—this contract was based on the practical demise of Landsat 4 and 5. Do we—can we—do we have that contract? Can we take a look at that? For the record, is that clear? Would you provide that to us, please?

Mr. Pyke. We'll be glad to provide a copy of the contract for——

Mr. McMillen. Because if there is a quid pro quo here that EOSAT's understanding was that there was a linkage between the continued funding for 4 and 5 till its practical demise and this $10.8 reinvestment, if you will, then it seems to me that you ought to consider reprogramming the payment at the end of this month, the $2.5 million. Would you be willing to do that, Mr. Pyke?

Mr. Pyke. We'll be glad to provide a copy of the contract to you. Mr. McMillen, it's my understanding that there is absolutely no linkage between the development of Landsat—in the contract, between the development of Landsat 6 and the provisions associated with funding of Landsat 6 and the funding of Landsat 4 or 5 operations.

Mr. Roe, with regard to your earlier comments——

Mr. Roe. Would the gentleman yield again? Would the gentleman yield, from Maryland?

Mr. McMillen. Yes, sir.

Mr. Roe. There is a linkage. Because I recall the debate very clearly. It's too bad we don't have the time today to get everybody in here—and I hope we can manage to extend this another day, Mr. Chairman. But the fact remains there was a very strong debate that went on internally within the Congress as to whether or not the data that was being received from Landsat was being—was quality data; was the marketplace really there; which gave part of the reason for the negotiations as far as your—let me finish—where your people were involved; whether or not Landsat 6 would be of quality to equal the resolution qualities of the SPOT or better; and then thirdly, did we want to be in a position of even looking into 7. And the reason that the linkage is there in 7—I don't know whether you can put a linkage in paper, but I know what the discussions were about. The linkage was that if we were going to do something in number 7 ultimately it had to be something of real top drawer quality that was going to materially improve our capabilities.

I am anxious to hear now what agriculture says. What is their real need? I'm interested particularly in hearing what DOD says what their need specifically is. So the question that was before which has kept—has been a dilemma for the last 3 or 4 years is whether or not we and the Administration or the Congress do

Landsat at all. Now that hasn't been touched yet but I hope to bring that out in due course along the line.

Mr. MCMILLEN. My time has expired, but just one further note. If there is this linkage, and I hope you will provide that to me, would you consider reprogramming that $2.5 million payment?

Mr. PYKE. Mr. McMillen, and Mr. Roe—Mr. Roe, your comments are right on with regard to the discussion and the perceptions that everyone had in talking about the Landsat issue a year ago, and, in fact, 2 years ago in considering how important Landsat operations is as well as the development of the future submarines. What I was referring to earlier, sir, relative to linkage was specifically with regard to the actual negotiations of the contract itself and relative to the actual provisions of the contract, and it's in that regard that it's my understanding that there's no actual linkage between expectations for operations' funding, which is one part of the contract, and the provisions for continued development of Landsat 6.

We'll be pleased to provide the contract to the committee.

[The information follows:]

[The contract is on file in the offices of the Committee on Science, Space, and Technology.]

Mr. SCHEUER. Congressman McCurdy?

Mr. MCCURDY. Mr. Chairman, There's been a lot of finger pointing here on both sides, and I think Mr. Shays raised one point that needs to be addressed, and that is for the record, it has to be clear that neither the United States government nor the contractor was at fault for having the delays in 6 that occurred. I mean, unless we're going to point to the Challenger accident itself. I mean, the Challenger, for the record, is what created the greatest delay in the development of this program. Is that not a fact?

Mr. PYKE. Correct.

Mr. MCCURDY. And 6 had to be redesigned for a different launcher, is that not correct?

Mr. PYKE. That was a major factor; yes, sir.

Mr. MCCURDY. And those of us who lived through that, that 2-year hiatus, want people to realize that this has not been an easy task. You're in the hot seat and we're probably going to keep you there for a while. But the fact of the matter is that OMB has basically been calling the shots, or called the shots for the previous 5 years on this commercialization effort and we have had a lot of closed meetings and sat around the room with a lot of different players trying to figure out who in the hell was calling the shots over there, and my conclusion has been it wasn't NASA. Originally it was NASA. It's not now. Next, it was Commerce, but they've been bumped and squeezed by OMB. DOD—if this were a special access program, we wouldn't be up here worried about funding.

It's not. It is simply an open public commercial private-type of arrangement, quasi-public, and we're in a world of hurt. And I'm glad you're tough on the budget. I'm glad you're tough on these contracts. But the fact of the matter is the contracts have been squeezed so much that there isn't much room here for either side. And I have never for the life of me, Mr. Chairman, been involved in hearings, so many hearings over $9 and $10 million in the 9 years I've been in this body. I mean, over in DOD and others we sit there and, you know, if it's not billions, you know, it moves pretty

quickly. But we've been in more hearings over this amount of money, and, you know, I think OMB has lost sight of the forest. They're just down here among the trees and the weeds right now, and, you know, we're losing sight of this.

And that's why I commend—and I'm not sure I would have been prepared to say this much before—but I commend the Vice President right now for wanting to move forward on the Space Council, because no one is calling the shots. We've got the green eyeshade guys down in some basement somewhere deciding what our space policy is.

Commerce, however, cannot get off the hook. And you and the Secretary, you guys have to provide—you're supposed to be tasked with providing the vision for a commercial policy if we're going to have one. And, in order to implement that vision, you have to work with us. Just because Commerce is not a user doesn't mean you're off free. You are tasked with providing and being that linkage from taking the hand-off, taking the baton from NASA and DOD and all these other people, and handing it off to the commercial sector. And, until we have a civilian DARPA or some other kind of agency, you guys are stuck with it. So you cannot run from that responsibility, and just passing the hat. We understand your problems, but right now you're the only linkage we have.

So I think it's important that we keep this in mind and keep this in perspective, and not just be pointing over here, "Well, they didn't do it," and "They're not wanting to pay," and "DOD doesn't want to pay because they don't want a precedent of being the one taking up the operational costs." Well, the precedent is not there. Maybe they shouldn't be carrying the operating cost because we have told Commerce to do it, because Commerce has that responsibility for now. And until you complete the hand-off, and let me tell you there's been a lot of juggling of the baton here in the last couple of years on this hand-off, that until you've completed it you are stuck with the job.

And I just would hope that you would take that message back to the Secretary—and he's new and I know he has an interest here. But stand up to OMB, be tough and tell them what your responsibility is, and we'll take care of your weather satellites later. Let's just get rid—let's take care of this one right now. [Laughter.]

Mr. HENRY. Would the gentleman yield? Just very quickly, Mr. Chairman, for a quick observation?

Mr. SCHEUER. Of course.

Mr. HENRY. Yes, we're talking about $10 million in the interim et al. But I think we ought to make clear we were talking about transferring off half a billion dollars' worth of equipment that was turned over to a private vendor, and we're talking about another quarter of a million that is being turned over, and that's why looking, quite frankly, at the cash flow and all this in terms of, you know, why is EOSAT not in a position at this point to fund the operationals. And it's not to say that they aren't, but I think those are legitimate questions.

I think we are painfully aware of the frustration between Commerce and NASA in terms of who got stuck with handling the paperwork administration on it. That is part of the problem, but it is more than $10 million.

Mr. McCURDY. Well——

Mr. ROE. Would the gentleman yield? Oh, it's the gentleman's time.

Mr. McCURDY. Yes. I was just going to say to my good friend that that is true, and I'm not critical from that perspective. But the fact of the matter is we don't know what the commercial possibilities are out there today, and I think the French are probably even having some second thoughts right now and having to reevaluate their positions. And I understand in future hearings we may have an opportunity to hear from Mr. Pyke here what those negotiations with the French were. But that, again, is a future hearing, and some of us who have been involved in this longer are fully aware of that.

My only point, again, is to come back now in the middle of this stream, after squeezing the contract down so much, and it was—I'm entirely sure, quite frankly, if I'd been on that side looking at those numbers I would have even entered into the contract. But no one had, you know, was in a position back then to tell OMB that they were being outrageous. And what they've done is they've squeezed—they've squeezed the very blood out of this turnip so much that it is very questionable whether or not it can be commercially viable in the future.

So we have to ask ourself the question, re-ask that question: Before we turn this big investment over to the private sector, are we responsible for ensuring that that technology on 7 and 6 is good? That's what the next hearings will be about. More importantly, have we dropped the ball just in the name of squeezing every single dollar out of this we possibly can? Especially in light of the fact that there were some intervening actions outside of the control of any of us here that caused such problems?

Mr. ROE. Will the gentleman yield?

Mr. McCURDY. Yes, sir.

Mr. ROE. I want to compliment the gentleman particularly on his very lucid observation of the commercialization program. You're serving a great, a great service here because in the present authorization programs that are being sent up to us now from the Administration, and I don't mean this in any derogatory sense, there's a half a dozen items we're leaving out because we're going to commercialize that. And I say, Hey, whoop-de-doo, we're going to commercialize that and we're going to wind up in the same damn situation we're in now.

So I would assure you that this committee intends to look at every single one of them, as Mr. McCurdy is pointing out, so that we can still be dealing in reality. We can start dealing in some of the facts involved. Are we ready for commercialization? How do we do it? And how do we compete and privatization and the whole bit? I think that's an extraordinarily important activity now.

And one more point and then I'd certainly yield back to the gentleman. I think that he's made an extraordinarily important point when he says in all due respect to your Department, and you know I have high regard for you personally, coming back and saying, Hey, you're the only guys that we have out there in front right now, and this committee fought like hell to include the whole Space—what do you call it—Council, as you know. But you're the

only guys out front that can be the catalyst as far as commercialization is concerned. And if we're going to be in a point where we're quarreling with you guys, then we really got a problem.

And I thank the gentleman for yielding.

Mr. SCHEUER. Congressman George Brown?

Mr. BROWN. Mr. Chairman, I regret the need to intervene again, but we're now finally I think getting down to some points which needed to be made and haven't been made, and that is the commercial potential on this. The Congress authorized a study of the commercial potential which was to have been made by the Department of Commerce, which was only made available to me as a Member of Congress a few days ago, but represents the best analysis that has been made to date on the subject. It shows the commercial potential of this system.

If we make the technological changes necessary to bring it down to a 5-meter resolution and to maintain the spectral characteristics and so forth, estimated at over $600 million a year by the year 2000 and ranging up to that during the intervening years, for a total of $3.5 billion over the next 12 years. Now this is something worth fighting for.

It is not a commercially viable system at 30-meter resolution. It is not even competitive with SPOT, which is a 10-meter resolution. But given the imagination and the guts to go ahead with what we know we can do, it is commercially an extremely viable operation, given our willingness to stick to it over this intervening period of years, and this is the thing that we need to keep in the back of our mind. This is not a $10-, $15- or $20-million-a-year operation. This will very quickly run into the hundreds of millions, and possibly even the billions, of dollars.

Now, up until last year, because of certain constraints exercised by certain agencies of this government, we didn't even know whether we could put up a 5-meter-resolution system. We now know we can and that we're going to have to in order to extract the commercial benefits from this kind of a system, and we're prepared to do so.

This may not be an appropriate subject to bring up in this particular hearing, but it has to be in the back of our minds or else what we're talking about doesn't make sense here.

Mr. SCHEUER. I totally agree and I think this is an excellent summary of where we are now.

Thank you very, very much, Mr. Pyke. I'm sure we'll be calling you back here in the months to come as we have the chance to hear of the Administration's long-term program and many public policy decisions involved therein. Thank you very much.

Mr. PYKE. Thank you, Mr. Chairman.

Mr. SCHEUER. We'll now hear from Mr. Charles P. Williams, President of the Earth Observation Satellite Company, the EOSAT that you've been hearing about. Will Mr. Williams please come to the witness table?

Well, Mr. Williams, we're very happy to have you here today. We're calling you out of turn before several members of our committee, including the chairman of the full committee and Congressman McCurdy, are members of the Intelligence Committee and they are—they have to leave us at 4 o'clock. So I'm going to ask to

hear your testimony and then recognize the chairman of the full committee and Mr. McCurdy before the rest of the members.

You've heard a great many comments pro and con about the fashion in which this whole satellite, earth remote sensing satellite program has been administered, the absence of a forward-going public policy, some of the questions that have been raised, some questions about EOSAT that have been raised. Your prepared testimony will be placed in the record at this point and will be reprinted in full, so why don't you chat with us for 5 or 6 or 7 minutes, and then I'm sure we'll all have some questions for you.

STATEMENT OF CHARLES P. WILLIAMS, PRESIDENT, EARTH OBSERVATION SATELLITE COMPANY

Mr. WILLIAMS. Thank you, Mr. Chairman. As you indicated, I do have a prepared statement and it is, it has been submitted for the record. But I would like to make a few comments and, perhaps, it'll at least state EOSAT's position or point of view on some of the questions that were raised earlier.

A year ago this month when we appeared before you to discuss the continuation of the Landsat program we talked about many issues. And because of your leadership at that time and that of the members of the committee, EOSAT and NOAA were able to agree upon a contract modification for the funding and restart of Landsat 6 construction. Now, an element of that solution involved funding for the Landsat 4 and 5 operations. That was in April of 1988.

It is EOSAT's position that Landsat 4 and 5 operations and Landsat 6 construction and any element of commercialization were done as a package. They were not done independently. They were not talked about independently. They were done as a package and one depended upon the other. There is no way that we could have paid back $2.5 million per year out of profit if there was no profit. That was the basis for the repayment. It was the basis for our participation. It was also the basis for participation of our parent companies, Hughes and General Electric, and the additional elements that they would participate in and support as part of the Landsat 6 effort.

One of the major elements of the Landsat 6 support is a current element that you haven't heard about yet, but it's called the SeaWiFS. It's an instrument to be applied to the platform, which is a joint agreement that we're working out at the present time between NASA and EOSAT. In order for our parents to, one, try and hold the price line on the construction of a new satellite and a new capability, new instruments, and also add capability to that spacecraft requires a complete package as we originally recognized it and what was the basis for our proposal and our agreement in April of last year.

Now premature termination of the Landsat 4 and 5 spacecraft operations itself would adversely affect the availability of the remote sensing key data for a number of agencies. I know you're all well aware of that and I'm not going to repeat that or repeat the number of agencies that are involved. But we do support and a great majority of our data is used for government service and gov-

ernment support. Approximately 56 percent of the data that we apply or that we distribute today is used for government support.

I had a few comments here about having heard compelling reasons based on earlier testimony, but I'm going to have to avoid those right now.

I think that Landsat 4 and 5 spacecraft—in order to keep it very short—the instruments and the spacecraft themself, irrespective of the fact that they've encountered difficulties, are a testimonial to American leadership, if you will, technologically and leadership in the field of remote sensing throughout the world, and I think that's important to us in many ways.

Although we've experienced a number of failures on the spacecraft since they were launched, they still continue to operate and operate in a mode to provide data both to us and to the international community in a very supportive manner. I believe that based upon the recent experiences that we've had and also the instrument life extension program that we've conducted on Landsat 4 and 5—it's a basic program to try and extend the life of the basic instruments in order to extend the total life of the spacecraft—that we believe right now that some form of Landsat data, if you will, Landsat capability and functions will be available and allow us to operate and return usable data into 1991.

Now is that January? Is that December? We have no idea. Probability and reliability laws are as valid as a number of other laws in the universe day. We—our estimates are 1991 at best for some form of Landsat support data.

Now, following testimony last year and the signing of our Contract Modification 19, EOSAT continued to aggressively reduce our operations cost, and thereby the funding commitment of the government. A number of the things that we agreed to do as part of the basis for this overall package was to reduce the cost of operations of Landsat 6, and since we have assumed control of the Landsat program EOSAT, working in conjunction with NOAA, has reduced the operating costs and the operating requirement for a budget by approximately 50 percent. We have accomplished this while improving the delivery and introducing new products to the customers that we have today and the new customers that we've gleaned in that period of time.

Landsat in itself, and I am sure you are well aware, supports 11 international ground receiving stations. There are two additional stations—Pakistan and Ecuador—which are expected to come on line within the next few months. There are another 5 to 6 stations which have discussions with their governments under consideration right now. Now that's important from a number of points of view, but primarily it involves approximately $25 million in investment on the part of each of the foreign governments as far as the amount that they are required to capitalize with a start-up cost for each international ground receiving station. It is a commitment by a foreign government.

That in itself provides a capability, if you will, or a recognition that the U.S. effort is still a supportive effort, it's an effort that's needed in the world today, and it's something that they recognize the U.S. as still being the leader in. Now, the fact that the French and the Japanese have initiated systems efforts and launched satel-

lites, and the Indians have launched satellites and the Chinese will launch a combined satellite with Brazil in 1990, indicates that yes there are substantial and supportive detail or information in submarine data, it is used by a number of countries, and it is very worthwhile. If it wasn't, they wouldn't enter the field.

Now I think that in order to summarize where Landsat data is used, at the present time we've been able to identify the use of Landsat data in over 108 countries, and Landsat itself still represents one of the truly global-use systems operated by the U.S. today. And I think we have to share our concern with you, Mr. Chairman, and members of the committee, that the elimination of the Landsat program will, in our opinion, adversely affect the U.S.'s negotiating position with its international space partners, or proposed space partners, as well as send absolutely the wrong message to commercial businesses in this country as indicated by very early by one of the members that all of the commercial efforts that are envisioned today could be jeopardized or could be envisioned based upon what happens with the Landsat program. A very poor opinion and a very poor element of credibility is going to be established by what can or cannot happen on the Landsat program.

Now one other element was, should we now terminate Landsats 4 and 5, the domestic and international users would be driven to alternate sources for data. That's quite true. But by the same token, some of the users that we have today cannot find alternate sources of data. The number of frequency bands within the thematic mapper or the primary instrument on the Landsat spacecraft provide a capability that does not exist on the SPOT spacecraft, or the French spacecraft, the Japanese spacecraft, the French—I'm sorry—the Indian spacecraft or the proposed Chinese-Brazilian spacecraft. It simply does not exist there.

There is a higher spatial capability on the French spacecraft, but it in itself does not provide the frequency bands or the types of information that are required or capable of being provided by the Landsat spacecraft. That data would be lost to the world and to our agencies in particular.

Mr. SCHEUER. Mr. Williams, in deference to the 2 members who have to leave at 4 o'clock——

Mr. WILLIAMS. Yes.

Mr. SCHEUER [continuing]. Maybe you could conclude your remarks in the next minute or two so that they have some time, and then you'll have time to make additional remarks after they have to go to their——

Mr. WILLIAMS. Exactly what I was going to do, Mr. Chairman.

EOSAT stands prepared to continue its side of the unfinished transition as provided by Public Law 98–365 of 1984 and our contract with the Department of Commerce. However, we feel this cannot occur without the proper government support.

And with that I'd like to conclude all remarks, and then thank you for your attention and try to answer any questions you may have. Thank you, Mr. Chairman.

[The prepared statement of Mr. Williams follows:]

Statement of

C. P. Williams
President

Earth Observation Satellite Company

Before the

Subcommittee on Natural Resources, Agriculture Research and Environment

of the

Committee on Science, Space and Technology
U. S. House of Representatives

March 7, 1989

Mr. Chairman and members of the Subcommittee: I appreciate the opportunity to appear before you today to discuss a matter which is obviously of grave concern to us--the continued operation of the U. S. Civil Land Remote Sensing System--Landsat.

One year ago we came before this Subcommittee to describe to you the second major restructuring of the Landsat commercialization program since its inception, and to bring you up-to-date on the substantial progress of EOSAT's efforts to date. We reported to you that with the assistance of the Congress, NOAA and EOSAT had agreed to a single satellite program and the continued operations of Landsats 4 and 5. In addition, we described a variety of activities making a positive contribution to the overall commercialization effort.

Today, however, we come before you with a mixed message. On the one hand we believe that the Landsat transition process is working. On the other hand, however, we must tell you that we are in imminent danger of losing the keys to the success of that process. As of March 1, 1989, EOSAT, at the direction of the Department of Commerce, has commenced a formal shutdown process by which Landsat Satellites 4 and 5 will cease operations as of March 31, 1989, and after which current Landsat data will no longer be available. These vital national assets will simply be turned off. It is most ironic that our successful efforts with NOAA to extend the life of Landsats 4 and 5 in order to maintain

data continuity, to minimize the 'data gap', and to continue the commercialization effort in the face of increasingly tight budgets, are the source of our current programmatic problems.

The members of this Subcommittee are well acquainted with the history of funding problems and program interruptions that have characterized the Landsat commercialization effort over the past four years. It is not my intent, therefore, to dwell on these problems or the extent to which they have hampered and delayed EOSAT's efforts to reach the goal of full commercialization of the Landsat system. Instead, I want to review with you the progress that has been made toward the twin goals of commercial viability and United States' technological leadership in the face of programmatic and budget problems and the controversy they have generated.

The original concept for commercialization of the Landsat program was founded on the premise that a private commercial entity would have a greater incentive than the Government to operate the system in an efficient, cost effective manner, resulting in lower overall operating costs, and would be more responsive to market demand in terms of products and services -- that is, "market driven." These assumptions have already been largely fulfilled.

First, overall system operating costs have in fact been substantially reduced since EOSAT commenced operations. During the last full year of Government operation of Landsats 4 and 5, total costs were on the order of $36 million. During the current fiscal year (including funding requested for the last six months of 1989), the comparable figure has been reduced to $18 million -- about half of what they were before. Of the $18 million figure, only about $9 million would actually go to support Landsat operations. Of the remaining $9 million, approximately $5 million would be used to support NOAA overhead, and the balance paid back to the Government for services such as data processing and data communications links.

At the same time, system responsiveness to user needs has greatly increased. Last year, I reported on our development of new cost effective, state-of-the-art digital and image products, including geocoded (map oriented) data, various types of movable scenes, and even the introduction of Landsat data on standard IBM-compatible floppy disks. The utility of these products to our customers was further enhanced by our introduction of a new "user-friendly" format which has reduced data entry time and made the data easier to manipulate.

Most recently, EOSAT introduced last July a line of Thematic Mapper color photo products based on new laser recording technology which enables us to generate film negatives directly from digital data. The resulting products are sharper in appearance, contain more information for the end user, and may be custom-tailored to emphasize characteristics of the imagery which are of greatest interest for particular applications.

Landsat 4, which NOAA had substantially shut down and mothballed in 1984 due to early system failures, was reactivated by EOSAT in 1987, and in conjunction with the TDRSS series of satellites now provides the United States with its only direct source of Landsat data of both the Western United States and the rest of the world. Images of Chernobyl, Libya, and the Amazon Forest would not be directly available if Landsat 4 were not operating. In fact, the 'rebirth' of Landsat 4 as a vital part of the Landsat program has given the United States a more robust earth observation program than when the Landsat commercialization program started.

In response to NOAA's announcement that they would not fly an ocean color imager and their challenge to private industry to forge a government/industry partnership to fly this important mission, EOSAT and NASA are working jointly to add the Sea-Wide-Field-Of-View (Sea-WiFS) sensor to the Landsat 6 mission. This oceans sensor will provide global ocean color data of critical importance to a wide range of oceans science and research projects. It will also provide an important tool for monitoring the state of our coastal and oceans environments. In addition it will support our oceans industries, particularly fisheries. This project represents the real possibilities of space commercialization--that is the Government and private sector working together to provide a capability which would have otherwise been impossible.

Finally, in spite of growing international competition from the French, Japanese, Soviets and others, and despite Landsat's continuous programmatic and budgetary problems throughout the life of the commercialization effort, our customer base continues to grow, and overall revenue has been maintained during the last three years. This success is attributable in significant part to our establishment of an extensive international sales network, which now includes representatives in 15 countries on five continents.

Unfortunately, regardless of the successes which have been achieved to date, the Landsat system is not yet ready to be fully commercialized. The market is simply not ready to support the investment required to maintain United States' technological leadership and to provide the data sets required to meet user needs. Numerous private and public studies make it clear that the political, technical and market risk surrounding the Landsat program precludes commercial financing of the system. While we are headed in the direction of commercial viability, we are simply not there yet.

Even within the context of that original plan, EOSAT has made a substantial investment in the commercialization process. We have agreed to pay the Government $10.8 million of the total Landsat 6 contract cost of $220 million. In addition, the total cost of Landsat 6 and its associated ground segment is likely to go well beyond the $220 million price currently provided in our contract with the Department of Commerce. Any overages represent further investment on EOSAT's part. Finally EOSAT is investing substantially in market and product development activities, and in the addition of the Sea-WiFS sensor to the Landsat 6 mission.

To terminate the operation of Landsats 4 and 5 at this time is to ensure a data gap of at least 26 months during which time the commercialization effort will receive setbacks from which it is unlikely to recover. In addition to the tremendous negative impact on the ultimate viability of the Landsat system, the termination of Landsats 4/5 operations will have consequences in the following areas:

1. **Space Commercialization**: The Landsat commercialization program is a highly visible example of space commercialization activities in the United States. Termination of Landsat 4/5 operations sets a dangerous precedent with regard to future space commercialization efforts by casting doubt in the commercial sector concerning the government's role as a reliable partner.

2. **Foreign Policy**: Landsat has played a key role in successful United States efforts to establish and maintain an international open skies policy. Without a strong national program, our ability to maintain international adherence to an open skies will be greatly impacted. At the same time the United States currently has intergovernmental agreements with over a dozen international ground stations which receive and use Landsat data. Each of these stations represents an initial investment by the foreign government

operator of approximately $20-$30 million in reliance on the continuation of this program. Termination of Landsat 4/5 operations is regarded by these operators as an abdication by the United States of its commitments under these Landsat agreements, which will force them to rely on French, Japanese, Soviet, European Space Agency (ESA) or other sources of satellite data, thus inflicting immeasurable harm on United States' credibility in the area of international space cooperation.

3. **The Earth Observing System**: NASA is planning to fly the Earth Observing System (EOS) in the mid-1990s with a mission to evaluate and monitor temporal change in the global environment and to advance the state-of-the-art of satellite remote sensing technology. Data from Landsats 4 and 5, collected during the late 1980s and early 1990s, are critical to the success of the EOS mission because those data will provide a unique and indispensable baseline data set from which to measure changes in the global environment. Without such baseline information, it will be impossible to fully evaluate the significance of the data provided by EOS.

4. **Environmental Monitoring**: The Earth's environment is becoming increasingly fragile. Landsat provides important and sometimes dramatic information on the state of that environment. Such data are currently being used to help monitor the reforestation of Yellowstone National Park, deforestation in Alaska and the rain forests of the Amazon basin in South America, and the increasing loss of the United States' valuable Coastal Zone and National Wetlands resources. Pressure on our natural resources and environment demands increasingly sophisticated tools for monitoring and protecting those resources. The Landsat system is one of those tools, and it cannot be easily replaced.

5. **Competiveness**: The United States has invested well over $1 billion in the development of Landsat satellite remote sensing technology. As a result of this investment, the worldwide remote sensing marketplace is likely to reach $6.6 billion during the ten year period between 1990 and the year 2000. International competitors are now entering this marketplace, including the French, Japanese, Soviet Union, Canada, ESA, India and others. Termination of Landsat 4/5 operations will leave the United States without a credible competitor in this rapidly expanding high

technology market. While international cooperation in satellite remote sensing is a real and viable possibility, United States interests can be served only if we approach that cooperation with a strong national program. An operational Landsat program, in conjunction with NASA's EOS mission will insure that the United States maintains its technological and commercial leadership in satellite remote sensing.

It is for these reasons that we address this Subcommittee today with such a mixed message. The Landsat commercialization process is not dead. In fact, we have made great progress in the face of nearly insurmountable obstacles. However, if Landsats 4 and 5 are allowed to die because of budgetary limitations and programmatic squabbles we are in danger of terminating not only the Landsat commercialization effort but also two valuable national assets which cost the American taxpayer over $600 Million to build and launch into space. I do not believe it is an exaggeration to say that this would be a national tragedy of historic proportions.

EOSAT is prepared to meet the Administration and members of Congress and to renew our mutual commitment to the Landsat program. Rather than retreating from this challenge, let us forge a new partnership with the Federal Government which will allow us to continue to operate Landsats 4 and 5, and to build and launch Landsats 6 and 7 in the early 1990s as a prelude to private commercial operation in the era beyond. If we fail to forge such a new partnership we will lose access to an extremely important data source in the short run and abandon to foreign competition yet another high technology marketplace, created by the United States. The first step in this process is to find the funding required, $9.4 million now and approximately $18.8 million for FY 1990, to continue the operations of Landsats 4 and 5.

Thank you for your consideration.

Mr. SCHEUER. Thank you very much, Mr. Williams.

And now out of order, with everybody's indulgence, I'd like to recognize the chairman of the full committee, Congressman Roe, from New Jersey.

Mr. ROE. Well, I thank the chairman. I'll be very brief because we do have another thing we got to do at 4 o'clock.

Basically, EOSAT the creature is the operator of the system fundamentally in the market, or is that a fair commentary to make pretty much?

Mr. WILLIAMS. Absolutely.

Mr. ROE. And the Federal—I just want to draw that observation and I don't mean it in any other way, derogatory anyway, but when we talk about commercialization a lot of people get the impression that the Federal Government is out of the mix, if you like so as to speak, and then the whole thing is going to be done by private industry. And from what I've been observing in all of the issues that have been dynamically before us, I'm thinking about this issue, I'm thinking about the Long March rocket issue—ah, bup, bup, bup, a bup. There's one other one I can't think of offhand—that still require an enormous input on the part of the Federal Government. Isn't that—so it's not all, by any stretch of the imagination, private capital.

Mr. WILLIAMS. That's quite true.

Mr. ROE. And I think that we have to differentiate a little bit there so the average person or even our colleagues in Congress understand to us, or with us that, you know, this is the step that we're in when we start talking about commercialization. Is that fair play?

Mr. WILLIAMS. Absolutely.

Mr. ROE. Then, if we get to a point where the private enterprise has to be in a position of putting up "all" the money or a lot of advanced funding, and then Congress ebbs and flows and slips and slides and maybe yes and maybe no, that when we start to really get into the commercialization of the space program particularly that's not going to be a very invigorating idea to the private industry in the country. You're saying that, basically, right?

Mr. WILLIAMS. That's quite true, Mr. Roe. Our studies have indicated, I believe the same as many others, that private investors, especially equity investors or large capital investors, are very reluctant to invest in any effort that doesn't have a long-term commitment, rather than a year-to-year posture, behind it. And it's the same situation that we run into in dealing with other countries. Here we have a year-to-year budgeting posture and it puts us in a very poor bargaining position with respect to any other international situation.

Mr. ROE. Well, let me just conclude on two questions. One, it appears to me from what I've been observing over the years around here—well, let me ask this question. In the whole Landsat program, is it possible for—in your judgment, for and is the information of such import for private enterprise to provide the entire operation? Suppose Congress were to say, "Well, hey, guys, too bad. We're just not doing to do this," and private enterprise goes ahead and does it. Could you possibly make a profit on providing a half a

million dollars' worth of monies now to build number 6 and so forth and so on?

Mr. WILLIAMS. Absolutely not. It requires——

Mr. ROE. That's a very important thing to say.

Mr. WILLIAMS. It requires participation by both the government and private industry. The capital investment is simply too large.

Mr. ROE. So therefore definitely what we're coming back and saying is we look at commercialization of space, at least in the present posture, as based upon a partnership between industry and the Federal Government to be able to achieve the goal?

Mr. WILLIAMS. Quite right.

Mr. ROE. Is that fairly correct?

Mr. WILLIAMS. Very correct.

Mr. ROE. Now one other thing. The point of linkage, and maybe we weren't using it correctly or we were translating directly, but I always envisioned that number 6 was directly linked to 4 and 5, from my point of view. We wouldn't be doing 6 at all and all that, maybe the negotiations that went on at that time, unless we figured out what we were going to do with 4 and 5. Wasn't that really where we're at basically?

Mr. WILLIAMS. EOSAT's position and the position of our partners and owners is that it was a package deal.

Mr. ROE. That's where I'm coming from.

Mr. WILLIAMS. Everything was tied together in one way or another.

Mr. ROE. Let me ask this one more question. Well, we knew and you knew—and again I don't mean it disrespectfully. You knew and we knew that we only had 6 months of funding anyway. We all knew that. This shouldn't come as any great big surprise, you know. Hosanna! Hosanna! We've discovered what we knew we were doing in the first place. So really what we're trying to do is to get the act together and determine—and I think it's very timely—as to how we go in this whole situation because it does have a handle as to what we're going to be doing in commercialization in the future? Is that a fair commentary to make?

Mr. WILLIAMS. I think it is, yes.

Mr. ROE. Would you be out of business if we decided not to fund the money for 4 and 5? How would you handle that? How do you see as the entrepreneur? We don't—we can't come up with the money for 4 and 5 and we decide we have to turn off the switch. What happens? How do you see 6 in the—how do you see the whole marketplace at that point?

Mr. WILLIAMS. Well, there is 3 parts to your question. But, first of all, the request, as Mr. Pyke indicated, that EOSAT take over the total funding of Landsat 4 and 5 operations was rejected because it was simply not economically viable, and it, as a support element, was supposed to provide a small amount, or amount of profit that would take care of part of the risk factor of developing Landsat 6. Six, as you know, went through a large hiatus of approximately 15 months at which time no effort took place. But, by the same token, we agreed to a package deal and a payback based upon the fact that there would be monies to glean some profit from.

Mr. ROE. Do you figure that if we don't put up money for 4 and 5 that we're breaking the agreement on the package deal?

Mr. WILLIAMS. Absolutely.

Mr. ROE. I thank the chairman.

Mr. SCHEUER. Congressman Dave McCurdy, of Oklahoma.

Mr. MCCURDY. Mr. Chairman, thank you for taking us out of order, before the rest of the committee. The chairman and I have to go to an Intelligence Committee meeting, and we apologize for bumping others.

But, I would just—Mr. Chairman, if I had read this before I talked earlier, I probably would have been far more articulate. This statement in the record, the "Keystone Landsat Policy Dialogue," the report from that Center, of October of 1988 is an absolutely incredible articulation of the problems and the challenges facing Landsat and the commercialization of remote sensing, and some of the points I was trying to, in not a very good fashion, convey to our friends at Commerce I think are stated very well here.

And having quickly scanned that while you were speaking, Mr. Williams, there's one area that I was wanting to focus on that I think has been a criticism leveled at EOSAT from some of the competitors and others, and that is the question of your ability to market the product. And some would say you are unnecessarily hobbled by your experience of dealing with the Department of Defense for the last, or for the company, or the life of the company, or the—doing government contracts, and as a government contractor you weren't very good in the entrepreneurial end of going out and developing markets. I mean that's a criticism some people have made.

How would you respond to that? Have you learned anything about developing a market for Landsat? Were you overly optimistic about the potential when you got into this contract operation? And what has been done and what can be done to stimulate the so-called global market, and since, quite frankly, that responsibility falls to EOSAT because we're the ones that have turned it over to you? How do you respond to that?

Mr. WILLIAMS. With great difficulty, first of all. But the, I think the basic answer, Mr. McCurdy, is the fact that, one, was our original marketing plan a little optimistic in 1984 and 1985? Yes, it probably was. But it was also based upon a consistency of plan and the consistency of participation by both sides, and that consistency has not been there, and with the result that 3 or 4 times during the last 4 years there have been announcements that the system would be stopped, terminated. Landsat 6 was halted for 15 months. This all led to a complete erosion of image, if you will, and credibility on the part of the U.S. system.

Now, you're right. We have the responsibility to market that system. But by the same token, the fact that it has not maintained it in itself a consistent image over the last 4 years, if you will, has provided us with a great difficulty as far as trying to provide marketing impetus, marketing development.

Our original market development plan was for a period of 5 or 6 years, based upon a consistent thrust, a consistent investment on a long period of time. That hasn't happened. We have probably had

not more than one year of full consistent marketing pressure on the outside world. We spent a lot of time trying to repair image, if you will, and establish credibility in the marketplace, both domestically and internationally.

Is it there? I think yes, the market is there, and I think it is starting to become more and more aware of what the information is and the content is of satellite data. Otherwise, we wouldn't have the Russians trying to sell their 5-meter data. We wouldn't have the French, the Chinese and the Brazilians entering the same marketplace.

We need a consistent policy and a long-term consistent program in order to develop a proper marketing atmosphere.

Mr. MCCURDY. I thank you. And again, I would commend my colleagues to especially look at the section in the "Conclusions" about "Who's in Charge Here? or Leadership—A Crucial Need Now and in the Future," and I think that's something.

Mr. Chairman, we—I, again I personally apologize to the next witnesses, many of whom I have worked with in the past, for having to leave. It is not for a lack of interest. It is because of a prior commitment, and I look forward to reading their testimony. And I appreciate you letting us go out of sequence.

Mr. SCHEUER. Thank you very much, Congressman.

And now we'll come back to our proper order. Congressman Paul Henry, of Michigan?

Mr. HENRY. Well, thank you, Mr. Chairman. I think it's become very apparent to anyone who has been here this afternoon that as far as this committee is concerned the issue isn't whether Landsat ought to be shut down or whether it ought to be kept running or acknowledgment of the important uses of this kind of sensory information gathering and these kinds of devices. That is not the issue.

And I guess I, too, would join in the apology to those witnesses who have been reshuffled. But I think they are well aware from the comments of each and every one of us that we think shutting the thing down, 4 and 5 down while we wait for 6 just doesn't make sense.

But the issue is not shutting down Landsat. That becomes increasingly apparent to me. The issue is the question as to how much the Federal Government should subsidize the contractor and what the profit margins should be for EOSAT. And the issue for the contractor is to what extent the subsidies and the profit margins on Landsat 4 and 5 are linked to Landsat 6.

Other issues have been raised as well. I think Mr. McCurdy is absolutely correct when he says we also have a bureaucratic problem. When he raised the Keystone Center report and says, Who's in charge? I mean, I think we're aware for a couple of years there's been a lot of shuffling in terms of where the counting takes place and who runs it, Commerce, NASA, or who gets stuck running it, I guess has been part of the problem administratively in this thing.

But I must say I, in some respects, have to express some regard for those who have sought to guard the public treasury in this. Mr. Williams, you have told us that part of the issue here is the way in which you conceive the linkages of the Landsat 6 to the contract

relative to the operation of Landsat 4 and 5, what acceptable risk is to EOSAT.

But, in your testimony you indicate that Landsat 6 despite its delays, some of which were absolutely unforeseeable, that the Federal Government's giving you, as it were, $220 million of capital, paying $36 million for the launch, and you'll put in 10 million from EOSAT, and I don't care how you count it 20-to-1 ratio leverage out of capital turned over to you for the operational viability is pretty good investment from the public treasury.

And I guess such issues as what, in fact, the revenue cash flows have been, what your profit margins have been the last 2 years over expenses, and to what extent it's legitimate to ask you to pay back into the continuation of Landsat 4 and 5 since, while Landsat 6 is later and coming on stream, Landsats 4 and 5 are giving you more than you could have properly anticipated at the time the contract was entered.

I don't want to see Landsats 4 and 5 shut down. I mean, I'll say that. I signed Mr. Miller's letter. I was very pleased when I read in the Post this morning of the very fine leadership of the Vice President, taking some initiatives on this and not letting it be shut down. That's not to anyone's interest. It's not to yours. It's not to the Nation's. It's not to the users' interest in this. It's, in terms of the global competition in this area, it's not to anyone's interest.

It's also very clear, as Chairman Roe indicated, as well as Mr. McCurdy, that we lack a clear and consistent policy on the commercialization issue; and that, true, needs to be articulated. But I must say, from everything I've heard, I am much more sympathetic—although I don't like the stakes that are being played on it, I am much more sympathetic to those who I think are using this as a means of forcing the issue in terms of what responsibility EOSAT has to pay its fair share of the operating cost.

Mr. SCHEUER. Do you wish to respond?

Mr. WILLIAMS. Well, If I—I'm sorry. I thought that was in the form of a statement rather than a question, Mr. Henry. But, first of all, EOSAT recognizes its responsibility as far as its contractual relationship with NOAA and the Department of Commerce. The fact that the capital assets have been provided by the government was a contractual responsibility and relationship, and, as a matter of interest, the amount of money provided in the capital allocation of $220 million was not the minimum proposed amount for the spacecraft at that time. The amount of money proposed at that time was $232 million.

Now a compromise was reached because of a cap that had been placed on the budget, if you will, or the allocation at the Department of Commerce, and that was $209.2 million plus $10.8 million in payback in order to reach a minimum level, an absolutely minimum level that we could provide a spacecraft and a ground system capable of monitoring and controlling that spacecraft. That was an absolute minimum capital investment. That hardware is owned by the government, right, title and interest. It's not owned by EOSAT.

The Department of Commerce has oversight responsibility as far as the total tenure of the program, if you will, or the total contractual relationship, whichever is shorter.

Now the fact that EOSAT has made money or made a profit I am not going to apologize for. We are in a business affair. We're in a business relationship, and what we recognize in a business relationship is that both parties should live up to their contractual agreements, and that simply is not occurring. And that's our position now.

The fact that there are additional monies that are invested in, as I indicated earlier, 6, there is a relationship; that we're trying to develop between NASA and EOSAT which requires investment, additional investment. Not on the part of NOAA, but it is a great responsibility on the part of NASA in this case and a supporting responsibility on the part of EOSAT, but it does require investment.

There are other things as far as technical investments which have to be made by EOSAT in order to support this particular program. That relationship, that total package, if you will, that price package was made at a point in time when all the factors were considered and the risks were considered. Those have changed considerably at this point in time.

Mr. HENRY. But, Mr. Chairman, you know, and I recognize that, but I just want to reiterate the issue is really, for some of us at any rate, not the question of shutting down Landsat 4 or 5 or even the viability and the promise of Landsat 6 or even the viability of commercialization, which I happen to believe very strongly in. The question, obviously, is a financial thing in terms of burden sharing in operational cost, and I just think that should be made clear. Because for the last two weeks I've been reading as if there is some plot to destroy Landsat, and that is really not what the issue is, and I think that's increasingly clear.

Mr. SCHEUER. Well, Congressman, with all due respect, maybe there isn't a plot to preserve Landsat but we're going through a "Perils of Pauline" and Landsat is hanging on the edge of this cliff by its fingernails. And the question is, without doing a lot of philosophizing—we're faced with a condition and not a theory. They've got to give notice to several dozens of employees at EOSAT by the 15th of March. We're really at the edge of the precipice. We're on the cutting knife edge of disaster.

Mr. HENRY. And, Mr. Chairman, I have not been privy to negotiations and I know we've had discussions on the continuation of Landsat for the last 2 years and some of them have been entirely bureaucratic, but let's really put all the cards on the table here too, and I think maybe at some point we ought to get in some of the information in terms of what the margins are, what the cash flow is, how much is coming in from NOAA——

Mr. SCHEUER. Well, you ought to ask those questions. I intend to ask them later on today.

Mr. HENRY [continuing]. And to look at the data. I, you know, I don't like this kind of poker either, and I understand that. But sometimes it's—I think we've been unfair, potentially unfair in terms of starting as if NOAA has said, Well, we're going to shut it down. Maybe that's their only ability to negotiate with the contractor too.

Mr. SCHEUER. Well, I suppose there's a lot of potential unfairness out there, Congressman. This is a tough, cold world. You're talking about high stakes. And maybe there is some posturing and negoti-

ating going on, but I think that the prime purpose of this hearing is to assure ourselves that they're going to get together and they're going to produce a package for financing.

Now it may be that several of them have to play a part. You and I can't negotiate this. They have to negotiate it.

Mr. HENRY. And, Mr. Chairman, it's clear, unfortunate——

Mr. SCHEUER. We're trying to build a——

Mr. HENRY [continuing]. Yes—that we've got 6 more months on that contract right now to negotiate. But let's be clear in terms of the totality of what's being negotiated.

Mr. SCHEUER. And it's a very minor sum compared to the stakes that are there. Compared to the investment of a billion and a half dollars that we have made in the Landsat program to get to where we are, to achieve our competitive position, to produce some excellent technology that self-evident-internationally is performing above and beyond its expectations. This is success. This isn't failure. But we're about to convert success into failure. We're about to seize defeat out of the jaws of victory, and this is what has all of us, Democrats and Republicans, absolutely apoplectic with frustration, and we want to end that.

Now certainly one subset is, well, in good faith shouldn't Landsat step forward and be part of the group that's going to solve this problem? Of course that's a major question. But the basic question that we're facing today is how to end this "Perils of Pauline," where the poor young girl is hanging over the cliff by her fingernails, for goodness sake.

They have to put out notices of termination of service by the 15th of March. We're in a crisis situation. And, hopefully, once we get over that and once Congress knows where we're going and there's some assurance of continuity of funding sufficient for us to make decisions on a supplemental appropriation, and, hopefully, a change by the Administration in its refusal thus far to provide any funding for Landsat 4 and 5 in its 1990 budget, we'll have plenty of time to get into those. But first, we have a life-saving operation to do. This is a blood transfusion to preserve the pulse and the life systems.

Congressman George Brown, of California.

Mr. BROWN. I'm going to follow up very briefly on a couple of other points that have been made. That you've opened up, at least.

Mr. Roe raised the question of the need for a partnership arrangement for some continuing Federal, United States Government backstopping of this commercial, commercialization process. I wanted to raise—and I agree with that and I'm sure—you indicated you did too. I wanted just to have in the record what is the situation with regard to other countries? Is there any other country that's attempting to move into this area as a solely private enterprise without government backing?

Mr. WILLIAMS. No, absolutely not. Not that I'm aware of, Mr. Brown.

Mr. BROWN. In the SPOT system there's a very substantial government involvement.

Mr. WILLIAMS. The SPOT system is basically, from my point of view, 98 percent financed by the French government. That portion that's provided by the Belgium banks and the other participants is

guaranteed by the French government. From my point of view, that's a full guarantee.

Mr. BROWN. And, of course, the same is true with the Chinese, the Indians, probably the Japanese as well.

Mr. WILLIAMS. That's quite true. Every system that has been launched today, or to date, or a system that is planned to be launched in the next 3 years that we know of is backed basically by the governments.

Mr. BROWN. So we're trying to put it on the—make the private sector here responsible for competing with the governments of these other countries?

Mr. WILLIAMS. Basically, that's true. A government-subsidized program in every situation. The one small area that is being considered is data distribution. That portion is being—has been tried for the last year and a half by ESA—European Space Agency—as a commercialized venture. That hasn't gone very well. SPOT Image, to the best of our knowledge, and based upon their released figures, have met only about 50 percent of their goal for commercializing their effort in the U.S., and that's for data distribution again, processing and distribution only.

Mr. BROWN. You mentioned that you began commercialization planning back in 1984, I think.

Mr. WILLIAMS. '83 and '84; yes.

Mr. BROWN. '83 and '84. Was that planning at that time based upon the continued utilization of 30-meter MS and TM data?

Mr. WILLIAMS. Not the—I'm sorry. Yes, it was based upon the continuing utilization of 30-meter data, but it was also based upon a package of 2 new spacecraft, Landsat 6 and 7, which were to provide enhanced capability over and above the 30-meter resolution. So we would maintain the 30-meter resolution for continuity of data to the users, the user community, if you will, the value-added community, but we expected to have an enhanced platform on Landsat 6 and 7, better capability, if you will.

Mr. BROWN. Better resolution?

Mr. WILLIAMS. Better resolution.

Mr. BROWN. What kind of resolution were you thinking of at that time?

Mr. WILLIAMS. At that point in time we were talking about 15-meter resolution on Landsat 6, and 15-meter or better resolution on Landsat 7.

Mr. BROWN. But at that time that was contrary to national policy?

Mr. WILLIAMS. I don't know that, sir.

Mr. BROWN. You don't.

Mr. WILLIAMS. No.

Mr. BROWN. Okay. Was the idea of the possible utilization of the data stream by the national media under the general rubric of what we now call Mediasat, did that enter into your commercial considerations?

Mr. WILLIAMS. Not at that point in time. That was something that was discussed in 1986 and '87 initially with a number of people that were in the media at that time. They were looking for 5-meter resolution at that time, and as of 1988 they were looking

for 3- to 5-meter resolution, or something called Mediasat or something similar to that.

Mr. BROWN. Are you aware of whether or not that could be done today?

Mr. WILLIAMS. No, I'm not personally aware of that. If I read the newspapers correctly, the original policy was 10-meter resolution limitation, and as I understand it today there is no known resolution under executive order.

Mr. BROWN. Would that question of permissible resolution with the permission emanating from government policy be a factor in the degree to which you could profitably commercialize?

Mr. WILLIAMS. In a number of instances it can, yes. In my personal opinion, I don't believe that in order to provide an adequate commercial platform that we would have to go to better than 10 meters for commercial applications, 10-meter multispectral applications. Now, as far as what the media requires, or what they think they require, they're looking at 3 to 5 meters as to the size of the object they'd like to see on the ground, but they'd also like to have real-time coverage or every day or every other day coverage. Frequency of coverage is important to them.

Mr. BROWN. Of course. That is another very important factor which I wasn't going to deal with.

Are you aware of what the resolution proposed by the French SPOT for their next couple of generation submarines is?

Mr. WILLIAMS. What they have proposed, based upon 2 meetings that were held about 2 months ago, is 2 things that I'm aware of. One is to continue their 10-meter panchromatic or 10-meter black and white imagery on through into Landsat—I'm sorry—into SPOT 4 and to attempt to provide a 5-meter instrument on SPOT 4 or on an alternate platform which they will use for both military applications and commercial applications.

Mr. BROWN. And the Soviets are providing 5-meter resolution now?

Mr. WILLIAMS. The Soviets are providing a, what is called a 5-meter resolution on a KFA-1000 camera, which is actually a camera taking images. It's not a digital platform.

Mr. BROWN. It's panchromatic or color?

Mr. WILLIAMS. No, it's multispectral.

Mr. BROWN. Multispectral.

Mr. WILLIAMS. It's a colored image basically 6 meters with images that can be resolved at a much lower level and much finer than 6 meter——

Mr. BROWN. Would a 10-meter multispectral Landsat capability be able to meet commercially—compete commercially if the French were to have and offer a 5-meter multispectral resolution capability?

Mr. WILLIAMS. I believe it can primarily because of 2 things. One is that the increase in resolution from 10 meters to 5 meters is a very large incremental step, a very costly step. You're talking about $200 or $300 million as an increment, and you have to determine the economic viability. I don't believe it's economically viable to do that.

But at 10 meters with the multispectral capability or the large, or number of frequency bands that are provided in the U.S. instru-

ments, I think that we can cover all of the scientific disciplines that need to be covered today.

Mr. BROWN. Thank you, Mr. Chairman.

Mr. SCHEUER. Congressman—Congressman Paul Henry did raise an important point. I don't think it's the issue, but I think it's an issue. Namely, the willingness of EOSAT to play a respectable role in putting together a package of financing in which presumably the government agencies that rely on this data will also join.

From the point of view of EOSAT's revenues, wouldn't EOSAT—wouldn't it make sense for EOSAT to make some contribution, a significant contribution, to preserve the revenue flow that it is now enjoying from Landsat 4 and 5 beyond the point in time when you would have predicted that this cash flow would continue to come in? On a cost-benefit basis, or a risk-basis basis, doesn't it pay you in cold, hard, bottom line terms to make some investment in continuing this cash flow?

Mr. WILLIAMS. Well, I believe in part that it may. But, by the same token, Mr. Chairman, for EOSAT to continue, or to provide additional investment over and above the investments planned for 6 and the additional investments that we're making right at this moment gives us no guarantee that the government is going to continue their side of the contract.

Is the government going to continue its side of the contract beyond October 1st? We don't know that at this moment. And that portion of the risk, in addition to the investment that we're contemplating right now for Landsat 6, puts the owners, if you will, my owners—Hughes and General Electric—at great risk as far as the potential investment is concerned.

Mr. BROWN. Well, what is at great risk is your prospects for cash flow from Landsat 6 if 4 and 5 are turned off. Because then you're going to have a year-and-a-half or a 2-year black hole where you cease providing information to contractors who have been depending on it. They're going to have to look elsewhere. You're going to be viewed, perhaps through no fault of your own, perhaps you have been subject to abuse, perhaps you've lived up—you've been willing to live up to your end of the bargain, whereas the government perhaps has not. But you will be viewed, Landsat will be viewed as a very frail, indecisive, uncommitted, and unreliable partner if there's a glitch here and your—and that light is turned out for 2 years. That does not reflect well on the bottom line prospects for Landsat 6 when they come in because you're going to lose a lot of the customers who would naturally be delivered right to Landsat 6 assuming 4 and 5 continue to function for another couple of years.

So it seems to me you have a—especially in consideration of your substantial investment in Landsat 6, you have a hell of an interest on the bottom line of preserving the continuity of that market until Landsat 6 becomes operational and all of those customers can then segue from Landsat 4 and 5 into Landsat 6. Is that not true?

Mr. WILLIAMS. That's quite true.

Mr. SCHEUER. Okay. Can you tell us what your bottom line cash flow is on a monthly basis right now from Landsat 4 and 5?

Mr. WILLIAMS. Bottom line cash flow, you mean as far as the amount of profit——

Mr. SCHEUER. That's what I mean.

Mr. WILLIAMS [continuing]. From the total operations and everything that occurs?

Mr. SCHEUER. 4 and 5, bottom line. What does it produce in terms of cash flow that you would lose if that light switch is turned off?

Mr. WILLIAMS. Ah, let's see. Probably on the order of 600,000 to 700,000 per month.

Mr. SCHEUER. So you could make a calculated guess that if it continues for a year there's 7 or 8 million bucks there. Two years, until 1991, 15 million. Now I don't know how you compute what the actuarial likelihood is that these 2 great satellites that have already outlived their life expectation are going to continue to crank along happily pumping back invaluable information to us for the next year and a half or 2 years. But certainly, if there's in the nature of $7 or $8 or $15 million worth of revenues that you would receive, that's worth some kind of an investment, isn't it?

Mr. WILLIAMS. It possibly may be, Mr. Chairman, and I—of course, that's not my decision to make. But, by the same token, remember that the investments that EOSAT makes it makes out of its profit too. Investments that we make on both elements of the system, 4 and 5 and/or 6, we make out of the profit.

As soon as we learn the details of the, and what understanding has been reached in some way, shape or form of the meeting that was held by Mr. Quayle, the Vice President, and the agencies that were involved, perhaps we'll have a better understanding of what their intentions and what we could bring to our board and propose to them as a situation that might be equitable for all parties.

Mr. SCHEUER. Well, I think that's a respectable position. I'm not trying to force you to divulge information that you don't want to divulge. I don't want to interfere with your bargaining posture. And it seems to me that there's got to be a little give all around, and what you've said to us makes sense.

Can you tell us what your current revenues are from the foreign ground stations that pay you licensing fees to receive Landsat data directly? What are your revenues now for 4 and 5?

Mr. WILLIAMS. About 6.8 million per year.

Mr. SCHEUER. Well. So, in other words, from the revenues from selling the information to the general market would be 7 or 8 million, so you can add another 6.8 or 7 million, so that gives you $15 million for one year, and presumably another 15 for the second year. Is that correct—if they last?

Mr. WILLIAMS. That's what we would lose but it's also minus the cost of operation and everything else that goes with it, Mr. Chairman.

Mr. SCHEUER. That's correct. Well, I asked for bottom line figures that would subsume the cost of operations.

Again, I don't, I don't want to press you. You've got some hard negotiating to do. It's obvious that the government is playing hardball here. And I think a point that Paul Henry made is that we oughtn't to be engaged in these crisis negotiations at the 11th and a half hour.

We understand what motivates the government. We understand what motivates you. But it doesn't make very good public policy to have this kind of uncertainty about—to have this kind of threat to

the continuity of information to government agencies that's vitally, to private industrial people in this country that need it, to developing nations, over a hundred of them around the world—it isn't very good public policy to be threatening the continuity of that flow of information while this rather—I mean, you're—they're acting, the government and you are acting like a bunch of rug traders when real national interests are at stake. Environmental monitoring, global environmental monitoring that benefits all of mankind is at stake, and it seems to me for this rug trading or horse trading to be going on and jeopardize clear national interests, clear global interests in global environmental monitoring, nobody is really thinking about the major interests that are at stake while all this higgledy-piggledy negotiation is going on.

You sort of alluded directly—indirectly, if not directly, to the fact that the government really hasn't lived up to its part of the compact. They haven't lived up to their clear contractual obligations. Is that an unfair statement of——

Mr. WILLIAMS. No, that's quite fair.

Mr. SCHEUER. Will you elaborate on that?

Mr. WILLIAMS. The original contract that was consummated in September 28th of 1985 called for 2 spacecraft plus a new ground system, if you will, to support those 2 spacecraft, Landsat 6 and 7. It also called for the operation of Landsat 4 and 5. Subsequent funding difficulties, and I believe Mr. McCurdy brought it up, the *Challenger* incident, plus the funding difficulties, plus the budget restrictions, if you will, that came about after that in the Gramm-Rudman Act, and a number of other things put the Department of Commerce in a very poor position as far as being able to support their own contracts. They were unable to support it for a long point in time, and I'm sure you're aware. We had many appearances and many committee meetings to review the Landsat 6 issue.

At that point in time that portion of the contract was obviated. It was completely stopped. There was no Landsat 6 for a period of about 16 months. It was resurrected, with the help of this committee, and it was resurrected in the form of a $220 million program for a single satellite system. Not the original 2 satellites and not the new, or a supportive ground station. It was a different dollar value, quite true. But by the same—point, we're talking about some 2 years later in time.

And the same thing is true right now of some of the studies that, as Mr. Brown indicated, you have—you are privy to but, by the same token, we are not privy to yet, and that's the fact of what is it going to cost in the out-years. We are trying to put together a package or a program here that's going to be a consistent program over the life of it.

The Landsat 6 problem was one issue. The second issue was the funding of the Landsat 4 and 5 effort for 1986. The third one was the funding of Landsat 4 and 5 issue for 1987 and 1988 and the partial funding for 1989. All of those elements were funding or budget elements that were problems. And sometimes, even though I don't like some of the things that are said by NOAA and the Department of Commerce, I sympathize with their problem. But, by the same token, I have a position I have to maintain also, and I have a contractual relationship to maintain.

I'm sure if I didn't maintain my portion of the contract they would be down just as hard on me as I want to be on them. But, by the same token, there are at least 5 different instances of budget problems which have came about which have influenced the total consistency or flow of the program itself. At least 5 times that I can recall at this point.

Mr. SCHEUER. Well, you know, I share your frustration. Before I came to Congress I was an urban developer and I developed projects in 9 American cities, large-scale urban renewal projects. And we would make, we would take months to complete our contractual arrangements with the city and then things would happen, there would be changes and so forth, we would adhere rigidly to our obligations to proceed no matter what, and so on and so forth. But somehow or other, I had the experience time after time after time in city after city after city that when they decided the conditions had changed or it wasn't convenient to do this they would completely ignore their contractual obligations to move ahead in a diligent way, and they felt there was some higher morality that completely freed them from the obligations of observing their contracts, and this was a source of very great frustration, and it was very costly to me.

And you, really, if you want to continue having a relationship with the city, and these are 5- to 10-year programs and you can't disrupt relations—it left us virtually with no answer. We didn't want to sue the city. We wanted to continue working together to build and finish these projects that we had undertaken. But this higher morality that enables city decision-makers to just ignore their obligations because of some other city concerns, some other city interests, political or financial developments in the city that made it inconvenient, perhaps, at that time to observe the full letter of their contractual obligations just free them completely from living up to the contract, in their eyes.

So I sympathize with the problems that you're going through and I hope that in the very near future this new Council that the Vice President is chairing will come up with an evenhanded program of funding that will extend the life of 4 and 5 long enough for Congress to get a supplemental appropriation bill passed that will take us through till October 1st and give the Administration a chance to recalculate and jigger its budget request for 1990, because that has to be done if we're going to carry Landsat past midnight proceeding October 1st.

So I think this has been a very valuable exchange. I think everybody, perhaps, understands your dilemma a little bit better than they had before. And we thank you and we will be—undoubtedly be continuing a chat with you as these "Perils of Pauline"—they used to be on in the movies every Friday, I remember, as a kid—as this scenario extends week by week toward March 31st and then toward October 1st. I'm sure we'll be in touch with you. We thank you very much for your testimony.

Mr. WILLIAMS. Thank you, Mr. Chairman, and Mr. Brown.

Mr. SCHEUER. Now, it's now exactly 4:30 and we have 2 panels. The first panel with 5 people. It's almost a mathematical impossibility for us to get to the first—the second panel and it—what I would like to do is to inform the members of the second panel that

we will reconvene. We will not attempt to take up the second panel. We'll be lucky if we finish the first panel, and we'll probably have to go overtime on that.

These are all representatives of government agencies, the Department of Defense, NASA, U.S. Geological Survey, Department of Agriculture. We hope very much that you'll stay here. But I did want to tell you that it looks quite impossible that we're going to get to your panel tonight; and, if you feel the need to quietly retire, this is the chance to do so. Consider this your seventh inning stretch. Okay?

Mr. SCHEUER. We'll now call the first panel to the witness table:

Don Latham, former Assistant Secretary of Defense, Command, Control, Communications and Intelligence.

Dr. Barry Rock, Complex Systems Center, Institute for the Study of Earth, Oceans and Space, University of New Hampshire.

Dr. Ray Cline, Chairman of the U.S. Global Strategy Council.

Dr. Mark Settle, Chairman, Vice President—Chairman and Vice President of the GEOSAT Company, Inc.

And Dr. William Bishop, Vice President for Research of the Desert Research Institute.

We have now 25 minutes. We must be out of here by 5 o'clock because there's another happening taking place right then and we have people outside waiting to come in and set up the room and who are chafing at the bit to get us out.

I do want to save some time for Congressman Brown and I to ask some questions, so what we're going to do, really, is impose the 3-minute rule on you. There are 5 of you; that will give us 15 minutes, so we should be finished at 10 minutes to 5 and George Brown and I will split the 10 minutes of questioning. Of course your full statements will be printed in the record at the point at which you testify, but we're going to ask your indulgence in cooperating with us so that we will have some time to ask you questions.

So let's proceed in the order in which I named the witnesses. Don Latham, please take your 3 minutes and use them well, and I'm sure we'll have some questions for you afterwards.

STATEMENTS OF DON LATHAM, FORMER ASSISTANT SECRETARY OF DEFENSE, COMMAND, CONTROL, COMMUNICATIONS AND INTELLIGENCE; BARRETT N. ROCK, PH.D., ASSOCIATE PROFESSOR OF FOREST RESOURCES, INSTITUTE FOR THE STUDY OF EARTH, OCEANS AND SPACE, UNIVERSITY OF NEW HAMPSHIRE; RAY S. CLINE, PH.D., CHAIRMAN, U.S. GLOBAL STRATEGY COUNCIL, AND PROFESSOR OF INTERNATIONAL RELATIONS, GEORGETOWN UNIVERSITY; MARK SETTLE, PH.D., MANAGER, INTEGRATED EXPLORATION RESEARCH, ARCO OIL AND GAS COMPANY, AND CHAIRMAN, BOARD OF DIRECTORS, THE GEOSAT COMMITTEE; WILLIAM BISHOP, PH.D., VICE PRESIDENT FOR RESEARCH, DESERT RESEARCH INSTITUTE

Mr. LATHAM. Thank you, Mr. Chairman. As you know, I testified before this committee in the past on this same subject, and I'd just reiterate that nothing has really changed in what I said then to what I would say now, except the fact that in the intervening 2 years the Department of Defense has done additional studies,

they've worked with Landsat data and learned a lot more, and, if anything, one could say today that the value of this multispectral imagery to the Department of Defense has increased in importance, even more so than it was back in 1986.

So, while it is not, in the Department's view, a necessary, absolute vital national security instrument, it is very, very important to the Department and, as you know, they are one of the largest consumers of Landsat data.

To make a point here, I think it would be helpful if the committee—so that the Space Council, which I think is going to play a very important role here, that the committee might want to pose some policy questions to the Space Council so that you get back answers, hopefully, that are more definitive and would satisfy more people as to what is really going on, such as: How do you really want to manage this system since it is user driven and the users are not really in control of it? Is the data really valuable to certain agencies such as the Department of Defense? And ask for a quantitative assessment of that provided to you, even though it might be classified.

So I think that would be helpful in addition to asking the normal questions, as you already have, as to how this system is going to be funded and continued into the out-years.

Thank you, sir.

Mr. SCHEUER. Thank you very much, Mr. Latham.

I would ask that—I would ask unanimous consent—I would call upon my colleague for another indulgence—to hold the record open for 10 or 12 days, or even 2 weeks, to give you, Mr. Latham, a chance to write us, to submit additional testimony on exactly what questions you think we ought to address to the Space Council.

I appreciate your suggestion and the implication that you'd be willing to do this.

Mr. LATHAM. All right.

Mr. SCHEUER. And I'm calling your bluff in a most friendly and respectful way.

Mr. LATHAM. Okay.

Mr. SCHEUER. Please give it to us. We don't have the time to elicit it——

Mr. LATHAM. No.

Mr. SCHEUER [continuing]. From you today, and you probably will have a little bit of time to think through clearly——

Mr. LATHAM. Sure.

Mr. SCHEUER [continuing]. The questions that you ought to, that ought to be addressed to the Space Council.

Mr. LATHAM. In return for that, may I be excused? Because I have something I need to do tonight too.

Mr. SCHEUER. You surely may be excused.

Mr. LATHAM. Okay, sir.

Mr. SCHEUER. We're grateful for your testimony.

Mr. LATHAM. Thank you, sir.

Mr. SCHEUER. Thank you very much. And we'll be looking to, looking forward to receiving that additional testimony.

Mr. LATHAM. Okay.

[The information follows:]

Lockheed Missiles & Space Company, Inc.

C³I Systems Division, 8th Floor
12015 Lee Jackson Highway
Fairfax, Virginia 22033-3346

Donald C. Latham

20 March 1989

Congressman James H. Scheuer
2466 Rayburn Building
Washington, D.C. 20515

Dear Congressman Scheuer:

Pursuant to your request, I have developed a series of policy comments and questions on the general issue of Multispectral Remote Earth Sensing and the Landsat program in particular.

My suggestion is that the committee forward a version of the enclosed paper to Dr. Mark Albrecht, the Executive Secretary of the National Space Council, and request that the council address these among other issues in their upcoming review of the Landsat program.

Thank you for the opportunity to testify and comment on this very vital program. If I can be of any other help, please contact me.

Very Respectfully,

Don Latham

Donald C. Latham
President

DCL/ehf

Attachment

cc: Curtis Standford

Policy Issues and Commentary on

The LANDSAT Program

The current LANDSAT program can be characterized as a very important if not economically vital source of unique multispectral remote earth sensing data. At the same time, it has been a program battered by the attempt to "commercialize" the system acerbated by transfer to a disinterested federal agency for oversight and budget support and by competitive foreign systems which are heavily subsidized by their governments. The undisputed value of the unique Landsat imagery has been established by a wide spectrum of users across federal, state, and local governments and by numerous commercial industries such as petroleum, minerals and fishing.

Some Current Issues:

1. National Space Council Membership

The recreation of the National Space Council is an excellent initiative. That body is the most suitable forum for policy programmatic and budget review and for the formulation of a new LANDSAT national space policy. However, when programs such as LANDSAT are to be reviewed it is suggested that the Department of the Interior (DOI) be included as a member of the council. The DOI bureaus are very heavy users of LANDSAT data and should be major players in defining future LANDSAT system requirements.

2. New Federal Management Of The LANDSAT Program

The Department of Commerce, and NOAA in particular, have amply demonstrated over the last several years that the LANDSAT program does not enjoy very high priority - neither from a management nor a budgetary perspective. To help ensure the future of the LANDSAT program and especially the management of the development of LANDSATS 6 and 7, the National Space Council should prepare legislation to move the LANDSAT program management and budget to NASA.

Longer-Term Policy Related Issues

1. What is the government's assessment of the commercial viability of earth remote sensing without continued U.S. government subsidies, especially in light of foreign government subsidize competitors and current projections of demand?

2. What are the alternatives for the future of the Landsat program, given the results documented in the study reports recently released by the Department of Commerce?

3. What are the primary applications for which government agencies use Landsat data, what is the value of Landsat data to each user agency, and what is the consolidated U.S. Government requirement for Landsat data?

4. What is the relationship between the Landsat program and the proposed $15-30 billion "Mission to Planet Earth," and how would the curtailment or termination of the Landsat program impact the sources of data for "Mission to Planet Earth"?

5. Landsats 4 and 5 may cease operating in the near future due to natural causes. What impacts would occur? What government remedies are available?

6. What contribution does earth remote sensing make to the "space leadership" objective stated in national space policy? What effect would the demise of Landsat have on U.S. spaced leadership?

7. What would be the foreign policy implications if Landsat data were no longer available, due to satellite demise or lack of U.S. government support, to those foreign countries which have purchased Landsat earth stations? What effect would such a situation have on "open skies" policies?

8. What are the pros and cons of joining a foreign government (or governments) in a cooperative earth remote sensing program, including ramifications in the economic, political and security areas?

9. If it is decided that the Landsat program should be returned to a federally funded and managed civil space program, what will be the government's approach to accomplishing this? Of particular concern would be the rights to Landsat archive data and to other materials formerly owned by the U.S. Government which are now contractor property.

10. Should the U.S. provide a "certification of continued need" for LANDSAT type satellite systems? Factors such as economic intelligence and competitiveness, national security interests, and our ability to monitor global change should be considered.

Mr. SCHEUER. All right. Second, Dr. Barry Rock. Please take your 3 minutes and just chat with us informally. Is—is we is or is we ain't? Is or isn't the continuation for the next year or two of Landsats 4 and 5 clearly, indisputably in the national interest?

Mr. ROCK. In the global interest, Mr. Chairman.

Mr. SCHEUER. And in the global interest as well.

Mr. ROCK. Absolutely.

I'm trained as a botanist and I use Thematic Mapper to look at stress in vegetation, and I have some photographs, which I will not show simply because of lack of time. But it is very, very clear that Thematic Mapper alone provides the spectral coverage and the spatial resolution necessary to monitor stress in vegetation.

Vegetation, on the other hand, can act very nicely as a monitor of environmental conditions, especially if we're dealing with forest-type vegetation. They are sitting there day in, day out, year in, year out, century in, century out integrating with their environment, and if air quality changes, if water quality changes, if water quantity changes, if the insect infestations change, toxic waste, ozone holes, you name it, vegetation will respond in very predictable ways, and the way in which respond is cited in my testimony.

I think that Landsat because of its unique spectral coverage offers an opportunity to monitor response in vegetation that nothing else currently does. So that's one point that I'd like to make.

I'd also like to make the strong point for maintaining Landsats 4 and 5 for as long as we can because of the absolute value of continuous data sets. Perhaps you're familiar with the Mauna Loa record of CO_2 concentrations in the atmosphere. Where would we be if they decided at one point that, well, this was not really worth doing. We don't have the money to support these kinds of data set—data acquisitions. Let's not do it.

We can't afford to lose the Landsat 4 and 5 capabilities. If we lose them because of sensor failure, that's one thing. Something that I as a scientist can accept. If we lose them for Lord knows what reason other than because of sensor failure, then I feel that is criminal. That is ludicrous. I feel we have a moral obligation to maintain this very unique capability from the standpoint of monitoring vegetation and in turn monitoring change on a global scale.

Mr. SCHEUER. Moral obligation to whom?

Mr. ROCK. To the globe. To the people. To humankind. It's that simple.

Mr. SCHEUER. I was hoping you'd say that.

Mr. ROCK. It's that simple.

Mr. SCHEUER. I was hoping you'd say that. Thank you very, very much, Dr. Rock.

[The prepared statement of Mr. Rock follows:]

TESTIMONY OF

DR. BARRETT N. ROCK
ASSOCIATE PROFESSOR OF FOREST RESOURCES
AND THE INSTITUTE FOR THE STUDY OF EARTH, OCEANS, AND SPACE
THE UNIVERSITY OF NEW HAMPSHIRE

BEFORE THE
SUBCOMMITTEE ON NATURAL RESOURCES,
AGRICULTURE RESEARCH, AND ENVIRONMENT
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES

Mr. Chairman, thank you for the opportunity to testify today on the topic of the termination of Landsats 4 and 5. I would like to examine some specific examples of how this orbital sensor is uniquely able to detect, quantify, map, and monitor environmental conditions on our planet.

Certain types of the Earth's native vegetation are very sensitive indicators of stress and environmental change. Native members of the Northern Hemisphere forests such as spruce appear to act as "bioindicators" to monitor change in environmental conditions over time. Environmental factors of current interest and concern are temperature, moisture, atmospheric gas levels (carbon dioxide, ozone, methane), air pollutants, acid rain, toxic wastes and insect infestations. Recent studies suggest that response of sensitive species to environmental change is predictable and occurs in stages that may be detected using remote sensing tools such as the Landsat Thematic Mapper (TM).

Figure 1 presents the stages or levels of vegetation response to stress factors such as environmental change. Initial response to stress will occur at the biochemical level and will involve subtle changes in cellular conditions. Change in photosynthetic pigment amounts and types, as well as loss of leaf and canopy moisture may be cited as examples of such a biochemical response. If the stress factor is chronic and severe enough, the prolonged biochemical response will result in visual or morphological changes such as yellowing of leaves, foliar loss, and altered seasonal patterns (delayed leafing in the spring, premature color display in the fall, etc.). Long-term stress (decades or longer) will result in a replacement of species sensitive to the stress factor by more tolerant species so that the vegetation community composition changes over time.

Figure 2 presents a typical vegetation reflectance curve as seen by a field instrument called a spectrophotometer. Notice that a number of factors in the leaf influence the intensity of reflectance at various wavelengths. In the visible wavelengths leaf pigments such as chlorophyll dominate and changes seen here may relate to cellular-level biochemical changes in response to environmental stress. In the near infrared wavelengths variations in biomass and cellular condition dominate, while at the longer,

short wave infrared wavelengths, leaf and canopy water content influence reflectance. Reflectance data acquired for these wavelengths allow detailed assessment of change in vegetation. Note that the Landsat Thematic Mapper acquires data in six separate bands in this spectral region (TM Bands 1, 2, 3, 4, 5, and 7). Also note that the French SPOT satellite does not acquire reflectance data in several of the critical regions, especially those in which canopy water content is a dominant factor controlling leaf reflectance. No other civilian satellite sensor system, U.S. or foreign, acquires data from the spectral regions covered by the Thematic Mapper.

As an example of the use of Landsat Thematic Mapper for monitoring forest conditions and change, our forest decline or "acid rain" damage assessment studies will be cited. Since the early 1960's, the growth rate and state of health of high-elevation spruce-fir forests in the northeastern United States have declined dramatically. During the same period, a similar decline in spruce, fir, and beech has been documented in many parts of central Europe. Although the stress agents responsible for the observed decline have not been identified, various air pollutants, including acid deposition, ozone, and trace metals have been proposed. Developing a means of detecting, quantifying, and mapping forest decline damage from an orbital remote sensing platform has provided Earth-bound scientists with the opportunity to assess and monitor the forest decline phenomenon on a global scale.

Researchers in the Institute for the Study of Earth, Oceans, and Space (EOS) at the University of New Hampshire have focused their research activities on developing remote sensing techniques that will provide such a remote sensing capability. Our research, in collaboration with other scientists in the United States, Canada, and Europe, has demonstrated the high degree of accuracy with which the Landsat Thematic Mapper data alone can be used to assess and monitor forest damage conditions over large areas of the Earth's surface. The extended spectral coverage provided by the Thematic Mapper (TM Bands 5 and 7) is an essential capability which allows this degree of accuracy. An attempt to use SPOT data for the purpose of conifer damage detection on Whiteface Mountain in the Adirondack Mountains in New York proved unsuccessful.

Figure 3 presents satellite-derived conifer damage assessments in the Adirondack Mountains of New York, the Green Mountains of Vermont, and the White Mountains of New Hampshire. Note that the degree of damage is much more severe in the Adirondacks, while damage is moderate in the Green Mountains, and fairly light in the White Mountains. This west to east gradient of damage is consistent with measured gradients of airborne pollutants, including ozone, in addition to wet deposition pH (Figure 4). Such regional damage assessments between or among different mountainous areas requires both an orbital perspective and the extended spectral coverage provided by the Landsat Thematic Mapper.

Monitoring change in vegetation over time that may be related to environmental change requires both routine data acquisition and a historical database against which to compare current conditions. Because environmental stress factors and effects frequently are difficult or impossible to predict in advance, the routine and continuous collection of data over time is essential. As an example of the value of such data acquisition, a current study of damage in sugar maple caused by a small insect called the Pear Thrip will be cited.

The Pear Thrip is a small insect (approximately the size of the letter "l" on this page) that normally attacks orchard species such as apples and pears (thus the name). In 1978 an infestation of sugar maple by the Pear Thrip was noted in Pennsylvania. In 1985 scattered damage in sugar maple in Vermont was noted, and in 1987 approximately 22,000 acres of maples were affected. In the spring of 1988, well over 500,000 acres of maples were "Thripped" in Vermont alone, with much extensive damage reported in Pennsylvania, New York, Massachusetts, Connecticut, and New Hampshire.

The Pear Thrip is active in the early spring, going from soil to the swelling buds of the maple in April. Upon entering the bud, the Thrip eats the young, developing leaf tissue, completely defoliating entire maple stands in May and early June. By late June, a secondary set of small leaves is produced by the maple to replace those primary leaves lost to the Thrips. In 1988 the damage to maple was extensive and the State of Vermont undertook the massive task of mapping areas of damage for the purpose of damage inventory, identification of areas for future study, and as a means of developing control strategies. Because the extent of damage (defoliation and/or heavy leaf damage) was not recognized until mid- to late May, and the maples had refoliated by mid- to late June, sketch mapping of damage was limited to a two or three week period. Due to poor weather conditions at this time, only limited sketch mapping was possible.

Routine data acquisition by the Landsat Thematic Mapper has allowed a Pear Thrip Damage study to be conducted at the University of New Hampshire. Thematic Mapper data were acquired on June 10, 1984 (a pre-Thrip year) and on June 5, 1988 (at the peak of Thrip damage), and a comparison of forest damage conditions between those two years has produced a highly accurate Thrip damage assessment. The extended spectral coverage provided by the Thematic Mapper (TM band 5) was once again extremely valuable in detecting and quantifying damage in the maples. SPOT data could not have been used for a variety of reasons. SPOT does not acquire data in the Short Wave Infrared (the area covered by TM Band 5); SPOT data were not available in 1984 (the most recent pre-Thrip year); and most importantly, SPOT data are acquired only on request (i.e. not on a routine basis). Since the level and extent of the Thrip outbreak could not have been predicted in advance, requests for data acquisition could not have been made.

Figure 5 presents a composite sketch map for southern Vermont,

while Figure 6 is a damage assessment image for a portion of this area. Note that the size of the areas damaged as depicted in Figure 5 vary between the left-hand side and the right-hand side. This is likely due to observer bias, since sketch mapping in Bennington County (left-hand side) was done by a different person than that done in Windham County (right-hand side). The satellite derived damage assessment does not show these differences because the image processing of digitized data is simply more objective.

In summary, the remote sensing techniques used in the detection and quantification of forest damage cited above require the use of satellite data acquired by the Landsat Thematic Mapper. The TM is onboard Landsats 4 and 5, and provides a unique combination of spectral coverage (from the visible to the short wave infrared reflected radiation, out to the thermal infrared) and spatial resolution (30 meter pixels) that allows the detection of forest damage using this technique.

Other satellite systems fail to provide the forest damage detection capabilities afforded by the TM. The French satellite SPOT does not acquire data in the same spectral regions as the TM and the current NOAA weather satellites lack both the needed spectral and spatial coverage. The future satellites proposed by the Japanese will not duplicate the spectral coverage provided by the TM. In short, there is no substitute, in terms of forest damage detection, for the data acquired by the Landsat Thematic Mapper.

If damage to forests can be detected early, then the progressive development of the decline mechanism may be studied and better understood. In the case of insect damage, safe control strategies can be developed. Hopefully, with improved understanding, the forests can be used as bioindicators of environmental change, and orbital sensor systems can be used to monitor forest change.

In conclusion, I would like to add my voice to concern raised regarding the proposed termination of Landsats 4 and 5. These Earth-orbiting satellites provide a unique perspective from which to study our planet. The loss of current forest damage detection capabilities provided by the Thematic Mapper would be tragic if the mapping and monitoring of the state of health of forests is important to mankind. The early detection of forest decline symptoms and other examples of vegetation response to environmental change on a global scale provided by Landsat provide an unprecedented opportunity for scientists to study and better understand perturbations threatening the habitability of the Earth, which most certainly is important to mankind.

While the montane boreal forests currently experiencing decline on a few mountain tops in the eastern U.S. and central Europe, and Pear Thrips damage in sugar maples may seem relatively insignificant when viewed on a global scale, it is well to realize that they represent only a small portion of a much more extensive Northern Hemisphere forest ecosystem. It is the opinion of many, including myself, that these forests are very fragile

plant communities that may well be acting as sensitive barometers of impending global change.

The present orbital capabilities provided by the Landsat Thematic Mapper **MUST** be continued if monitoring and mapping of forest health using remote sensing techniques is to continue. It is not just a matter of national pride, but rather a moral obligation that we maintain and expand this aspect of the United States space program.

Although my testimony has focused on forest decline and damage detection/monitoring capabilities, it is also important to note that these same remote sensing systems may be used to provide information regarding other processes of global concern. These include desertification, deforestation, pollution monitoring, wetlands degradation, global warming trends (greenhouse effect), ozone depletion, toxic wastes, etc. A strong Earth-oriented space program is required for such a comprehensive Earth-monitoring capability to be developed. The Landsat system **MUST** be a part of such a program! Thank you.

THE VALUE OF LANDSAT THEMATIC MAPPER AS AN ENVIRONMENTAL MONITORING TOOL

- The Thematic Mapper (TM) remote sensing system on board Landsat 5 provides the scientific community with a UNIQUE environmental monitoring tool.

- The UNIQUE capabilities provided by the Landsat 5 TM are especially effective in detecting, mapping and monitoring forest decline damage thought to be due to air pollutants, including acid rain, ozone, and toxic metals, as well as forest damage due to toxic waste disposal.

- Other satellite sensors such as the Landsat Multispectral Scanner (MSS), the Advanced Very High Resolution Radiometer (AVHRR) on board NOAA "weather" satellites, and the French satellite, SPOT, do not provide the spectral coverage of TM, coverage needed to detect forest decline damage.

- Continuous data acquisition by TM is required for the data to be used as a monitoring tool, especially when the dynamic response of vegetation is to be used as an indication of global change.

FIGURE 1. Vegetation response to stress

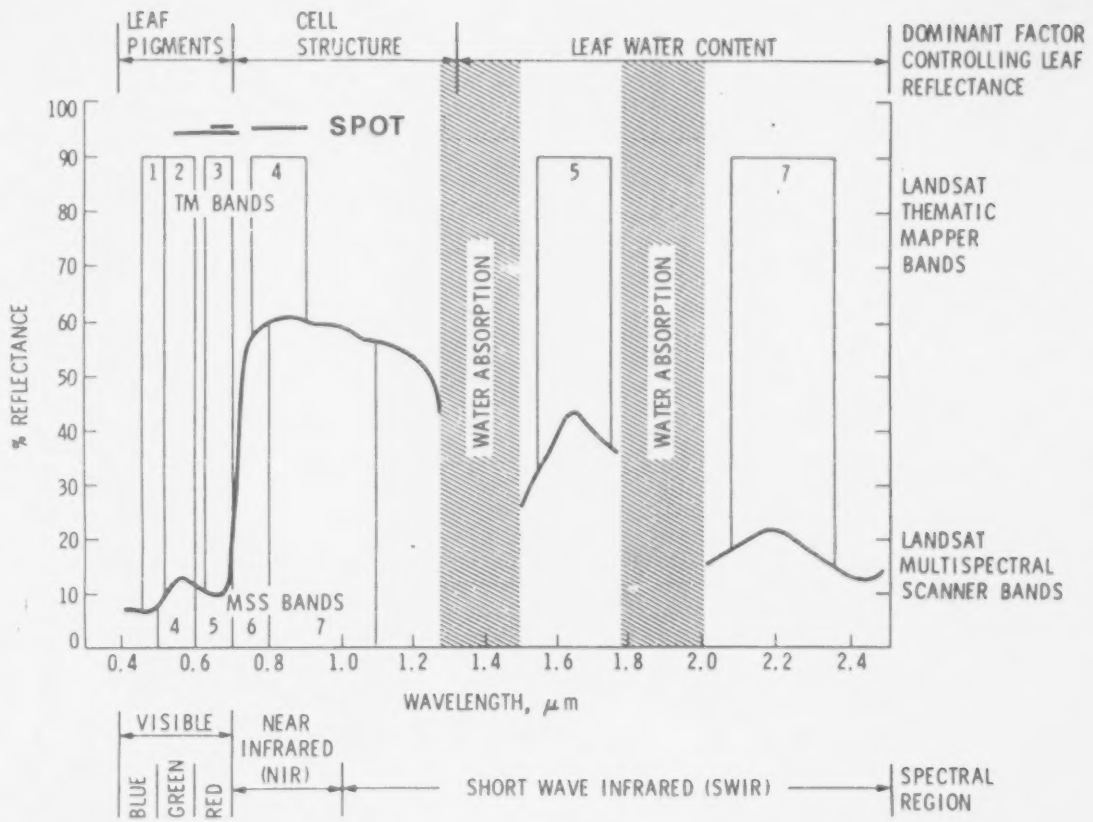


FIGURE 2. Vegetation reflectance curve

FIGURE 3. COMPARISON OF CONIFER DAMAGE DETERMINED BY SATELLITE DATA FOR THE ADIRONDACKS, THE GREEN MOUNTAINS, AND WHITE MOUNTAINS.

SITE	ELEV	% LOW DAMAGE PIXELS	% MED. DAMAGE PIXELS	% HIGH DAMAGE PIXELS	DAMAGE RATING
HIGH ELEVATION ADIRONDACKS					
WHITEFACE	1484	8.6	12.7	78.7	85.1
HIGH PEAKS AREA	1268	2.3	6.8	90.9	94.3
HIGH ELEVATION GREEN MTNS					
CAMELS HUMP	1244	26.5	20.7	52.8	63.2
MT ABRAHAM	1260	25.6	25.6	48.9	61.7
BREADLOAF	1165	37.9	24.6	37.5	49.8
HIGH ELEVATION WHITE MTNS					
MT MOOSILAUKE	1464	72.3	16.8	10.9	19.3
LAFAYETTE	1585	63.9	19.0	17.0	26.6

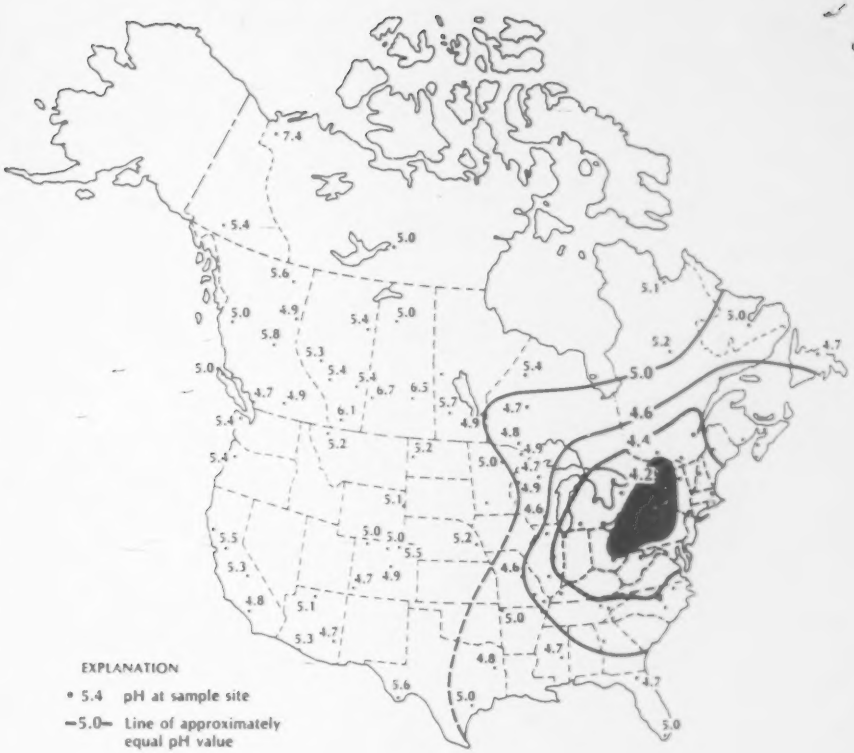


FIGURE 4. Mean annual-weighted pH values for the year 1982 (NAPAP, 1983).

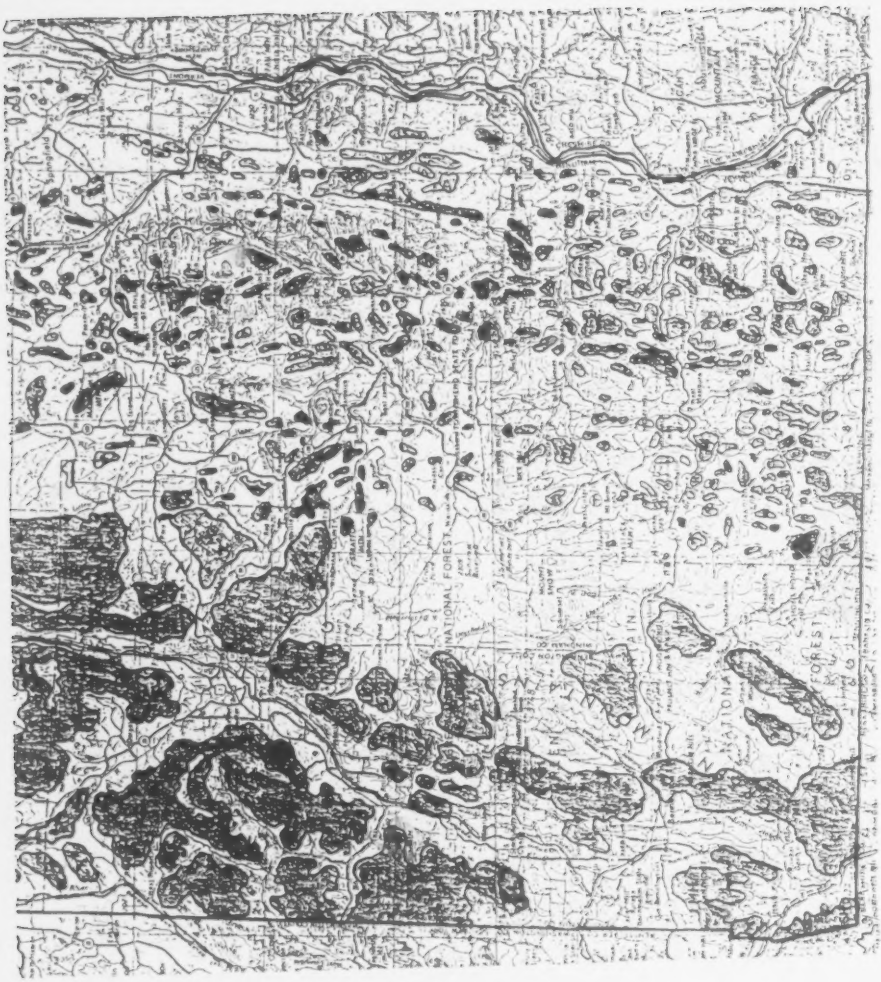


FIGURE 5. Sketch map of Thrips damage, 1988.

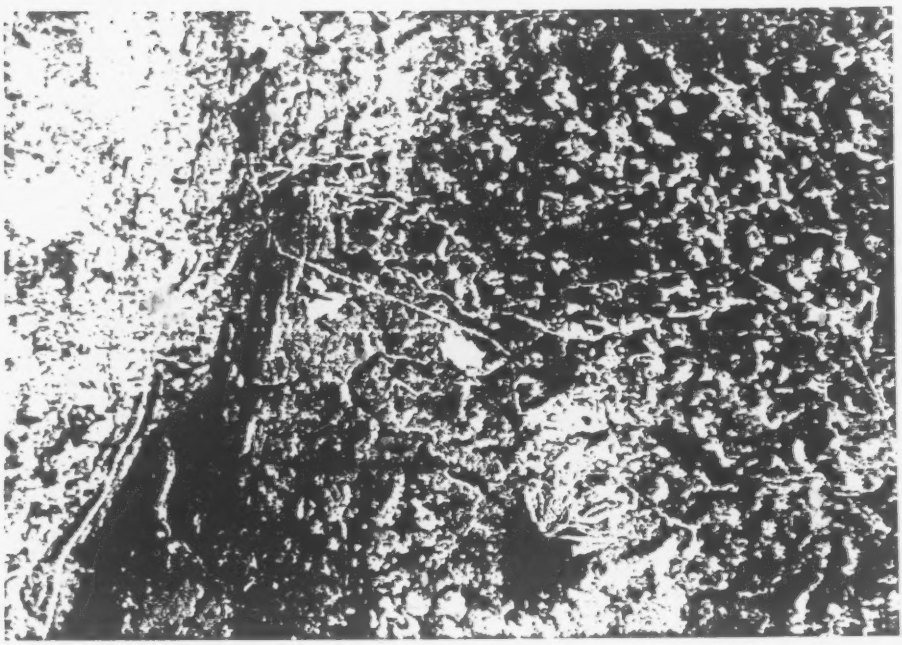


FIGURE 6. Landsat Thematic Mapper Damage Assessment Image of Pear Thrips damage, June 5, 1983.

Outlook Items on this page do not necessarily reflect the opinions of the Houston Chronicle.

Keep Landsat 'eye' in heavens, for Earth's sake

By DONELLA H. MEADOWS

OVER the next decade the residents of Earth will need to keep a critical eye on its surface — to keep track of surface warming, forest damage from acid rain, desertification and tropical deforestation. We can deal with global environmental problems only if we have accurate information about whether — and where — those problems are getting better or worse.

The good news is that we have that information. The Landsat program has been sending us satellite images of Earth's surface since 1972. Landsats 4 and 5, in orbit now, provide a complete global picture every two weeks. The wavelengths they scan are uniquely suited for detecting changes in vegetation. Thanks to them we have a historical record of the global environment and a sensitive early warning system to spot trouble.

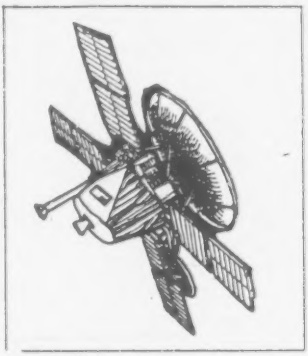
The bad news is that the National Oceanic and Atmospheric Administration is planning to stop collecting Landsat data after March 1, and will abandon the satellites April 1. The reasons for the move began with the Reagan administration's determination to privatize government functions and end with an unwillingness to come up with $26 million — out of a total government budget of more than $1 trillion.

The Reagan idea was that Landsat could pay for itself by selling Earth images to commercial clients such as oil companies, which use them for exploration. Responsibility for Landsat was transferred from the National Aeronautics and Space Administration to the National Oceanic and Atmospheric Administration, in the Department of Commerce, which created the Earth Observation Satellite Co., a private corporation managed by a coalition of aerospace firms. The job of the Earth Observation Satellite Co. was to market Landsat images.

Oil companies, it turns out, only need one good Earth scan every eon or so. The primary users of Landsat — scientists studying environmental changes, Third World countries doing basic resource inventories — were priced out of the market when the Earth Observation Satellite Co. quadrupled the charge for an image. The company's management squandered money, marketed poorly and became a continuous drain on the NOAA budget. Finally Congress, disgusted with the Earth Observation Satellite Co.'s inefficiency and in a mood for budget cutting, decided to pull Landsat's plug. The money saved will reduce the federal deficit but .002 percent, or about the cost of President Bush's inaugural fete.

If after March 1 the stream of data coming from Landsat is no longer received, a 17-year history of planetary information will be interrupted. If after April 1 the positions of the satellites are no longer maintained, the solar collectors will not stay pointed toward the sun or the sensors toward the Earth. The satellites will start tumbling. Further communication with them will be impossible.

We have other Earth-scanning satellites in the sky; so do France, the Soviet Union and other nations — the Japanese are about to put one up. All these nations have "open skies" policies; their data is available to us. But only Landsat reads the Earth through a set of high-resolution, near-infrared and shortwave spectral bands especially suited to provide information about stresses in the planet's vegetation.



Ms. Meadows is an adjunct professor of environmental and policy studies at Dartmouth College in Hanover, N.H.

Professor Barry Rock and his research team at the University of New Hampshire use Landsat to watch the effects of acid rain and air pollution on the New England forest. They correlate the wide sweep of satellite information with more thorough but scattered ground studies. The acid rain study is itself worth the price of Landsat, but every now and then the researchers find the satellite images not only predictably useful, but unexpectedly so.

Rock has found "acid rain false alarms," unusual spots of forest dieback that turned out upon ground inspection to be not acid rain damage but toxic dump sites. Through the satellite images, he finds not only the dumps but monitors whether vegetation returns after they are closed.

Late last June the Northeast suddenly realized it had a massive problem with a hitherto uninteresting insect called the pear thrip. It began rampaging through the sugar-maple forests, defoliating as it went. By the time authorities began to ask insistent questions, the insect's feeding cycle was over, the trees were putting out a late crop of leaves and the infestation was hard to map. But Rock could call up Landsat images from June 5, when the trees were maximally defoliated, and another set of comparison images from a previous, uninfested June. He could chart the insect's spread with great accuracy, to provide a basis for predicting its possible future advance.

These stories show the three essential features of Landsat: Its fine resolution (to 30 meters); its use of wavelengths particularly sensitive to vegetation under stress, and the continuity of its record. No one knew in advance that we would want to trace a New England pear thrip outbreak, the ecological damage from Chernobyl, the burning of the forest in Amazonia, the drought in the Midwest or the effects of the ozone hole on plants in Argentina — but when we did need to know those things, Landsat data was there waiting for us.

Landsats 4 and 5 have both exceeded their planned lifetimes. Satellites have a good record of doing that, however, and there is some hope that these might last until Landsat 6 is launched (now scheduled for 1992) — if the nation recovers its senses and decides, quickly, to keep them alive.

There are many ways to do that. Cancel the Earth Observation Satellite Co. and give NOAA a proper budget for maintaining Landsat. Or give the responsibility back to NASA. If we truly can't afford to provide the monitoring of Earth for all other nations of the world in the long run, at least keep these already-paid-for Earth monitors functioning as long as possible. Charge Secretary of State James A. Baker III to enter the international negotiations on the greenhouse warming and to seek a worldwide shared commitment for continuous satellite monitoring with data available to all.

It makes no economic sense to shut down Landsat. Doing so would be a scientific disaster. And at this time of great environmental uncertainty, it could be an ecological disaster, too.

Mr. SCHEUER. And now an old and valued friend, Dr. Ray Cline, Chairman of the U.S. Global Strategy Council.

Mr. CLINE. Mr. Chairman——

Mr. SCHEUER. Ray, tell us what you can in 3 or 4 minutes.

Mr. CLINE. I will be very brief. I hope you will include my statement in the——

Mr. SCHEUER. Absolutely.

Mr. CLINE [continuing]. In the record because I make a number of points I think the committee would appreciate.

But I will speak very briefly and very personally because, as you know, I feel that this satellite orbiting system with its imaging is something that I helped develop 30, 40 years ago, and I cannot understand how our government is screwing it up so much, frankly.

I know that——

Mr. SCHEUER. That may not be the Queen's English but it is certainly the King's English.

Mr. CLINE. You understand what I mean, I think, Mr. Chairman.

I feel that as a pioneer in our intelligence systems we did do the right thing in developing this technology and that it is a national asset which is important, as the previous gentleman just said, to the whole globe, to humankind, and we must not allow it to be degraded by our inattention to the budgetary requirements.

I think that President Eisenhower was the man who committed us to using this technology for information gathering, for making the public and the Congress and the whole world able to use information intelligently and credibly. As you know, he argued for an "open skies" system. I am advocating now that we return to a national policy of "open skies" which will require a partnership between government and private industry to make this system effective, make it work for the benefit of everybody, and make the United States credible as an instrument of international peacekeeping, economic development and environmental control. That is what we are talking about here.

I believe that there is no question, from what you have already said, where we should be going in this particular instance. But I want to urge you, Mr. Chairman, and the members of your subcommittee and the committee chairman to attack the problem as a policy problem, as a strategy problem, something that will pull our thoughts together and give us a long range program which will enable us to exploit this extraordinary technology which we are tending to throw away as we have thrown away so many advanced technologies.

Finally, just let me say, as we enter the 1990s we are in an information age. An explosion of data and the analytical ability to use it is going to be important to every policy move that the United States Government makes. So, as this information enters the public domain, we do need a policy that will use it for our purposes. It will determine who wins and who loses geopolitically as well as in other ways. Probably more than missiles and guns, this remote sensing technology will determine how the world is configured 10 or 20 years from now.

So I hope all the parties present today will resolve their differences, get a real partnership between private industry and government and fund the operations, not only of 4 and 5, but 6 and a

future exploitation of this excellent, ah, excellent resource for United States policymakers.

Thank you very much.

[The prepared statement of Mr. Cline follows:]

The Proposed Termination of Landsat

Hearings Before

The Subcommittee on Natural Resources,
Agriculture Research, and Environment

House Committee on Science, Space, and
Technology

March 7, 1989

Testimony before the Subcommittee

by Dr. Ray S. Cline

Chairman of the United States Global Strategy Council and Professor of International Relations, Georgetown University

Mr. Chairman and Members of the Subcommittee:

First, I would like to thank you and your staff personally for giving me the opportunity to present my views on why our orbiting remote-sensing program is in such dire straits and why we must do something to right it.

I suggest that the challenge you face, as chairman of the Subcommittee that oversees Landsat operations, is staggering.

In one 90-minute orbit, Landsat collects information that cuts across the jurisdiction of nearly every Congressional committee and subcommittee. Likewise, one image could contain information relevant for certain operations of every government agency. Therefore, you are to be commended for tackling such a comprehensive and important policy question.

My experience during the last fifty years of public service unfortunately has been that our government rarely swings into action until after it is confronted with a crisis situation. By any definition, this situation is a crisis waiting to happen. If the problems you are examining are not favorably resolved, the impact will range far beyond the jurisdiction of your subcommittee and the remote-sensing community in general. Therefore, today's hearing comes at an extremely appropriate moment because the nation's security is at stake. We should act before the crisis hits us.

There is no doubt in my mind that representatives from the Earth Observation Satellite Company (EOSAT) and the National Oceanic and Atmospheric Administration (NOAA) undoubtedly have valid analyses regarding the potential demise of Landsat, including who is to blame. However, my

purpose is not to examine past errors but to use our time today to determine what is best for the country with respect to Landsat.

With this background in mind, a vital question then becomes: Given the broad-based impact of information gathered by Earth-observation satellites, why has our nation failed to develop a conceptual framework which brings many elements together in order to form a cohesive civil remote-sensing policy? Such a policy must address commercial, environmental, economic development, military and intelligence-related applications, including them all in the context of our national security strategy.

In my opinion, the real reason why we are gathered here today revolves around this question. Solving the short-term funding crisis will not automatically give us a sound core strategy governing remote-sensing of the earth, one consistent with the national security interests of this nation. I will have more to say on that subject later on in my testimony.

But first, I think it might be useful to draw some historical parallels between my experience in helping to develop our nation's photo reconnaissance program in the 1950s and the way our civil land remote-sensing program was fashioned beginning in 1972.

In order to add some perspective for those present at this hearing, a brief overview of the circumstances associated with the development of our nation's photo reconnaissance capabilities may be useful. Many of the same factors that convinced President Eisenhower to develop overhead reconnaissance systems in the 1950s are just as valid today for Landsat and all civilian-operated Earth-observing satellites.

The world of the middle and late 1950s, as we often forget, was turbulent and full of change. The Soviet Union, while trying to catch the United States with respect to developing nuclear weapons and delivery vehicles, rejected President Eisenhower's offer for mutual inspection or "open skies." The Soviet Union was interested in concealing as much of its military activities as possible. I see no sign of a change in the future. The United States had an overriding need then, as

now, to understand the world and the nations it was dealing with so that an appropriate national strategy could be devised.

President Eisenhower had little choice but to make a strategic commitment to overhead reconnaissance capabilities. The development of the U-2 reconnaissance plane was speeded up and soon operational. Later, satellites were developed and became the principle means of photo-intelligence gathering, particularly after Gary Powers was shot down in 1960. In addition, national intelligence institutions supervised by the CIA were formed to maximize analysis and interpretation of the information gathered by overhead reconnaissance. In the early 1960s I was responsible for the work of the National Photographic Interpretation Center (NPIC). While there were many spectacular successes, these programs did not achieve overwhelming support overnight. We had to fight for funding just like EOSAT has to do today.

Of course, our fortunes took a turn for the better when Members of Congress and the general public realized the importance of overhead reconnaissance systems. The lesson was spelled out clearly in the Cuban missile crisis of 1962. The photographs taken by the U-2, which were presented at the United Nations, did more to persuade the international community of the correctness of our position than perhaps any other step taken by our government. I personally took these photographs to Ambassador Adlai Stevenson at the U.N. and dispatched teams of intelligence experts to display them in Ottawa, London, Paris, and Bonn. Over the years, there has been no question that our nation's classified surveillance capabilities have increased international security and stability and should be fully maintained.

In 1972 a twin system deliberately placed in the public domain was born with the launching of the unclassified Earth Resources Technology Satellite (ERTS), later renamed Landsat. ERTS was a direct response to the growing awareness of global environmental challenges. Even though the resolution capabilities of the first three satellites was quite poor, Landsat did much to reshape our perceptions of the Earth as an integrated ecosystem.

Starting in 1982, new vistas for knowledge were opened up when Landsat 4 was launched with a new instrument, the thematic mapper. With a resolution of thirty meters, the information was relevant for environmental and military planners alike. Images acquired by Landsat are used for famine-relief efforts in Sub-Saharan Africa through the Famine Early Warning System, a regular program of the United States Agency for International Development, and mapping programs at the Defense Mapping Agency. No matter how you slice it, Landsat is an unqualified success story.

Along the way though, our government made several critical mistakes from which the seeds of today's pending failure, which we hope can be avoided, were planted. First, we could never quite decide if Landsat was an operational tool or a long-term research instrument. The Carter Administration reasoned that it was an operational system, and that the government could save some money by making it a commercial venture.

The Reagan Administration followed through on this thought, and Congress soon passed the Land Remote Sensing Commercialization Act of 1984 (PL 98-365). A new entity, EOSAT, was soon formed to carry out the commercialization process, originally envisioned as a ten-year transitional period, to make Landsat a long-term public asset for disseminating knowledge in the developing information age. However, as we all know, the government failed to live up to its funding commitments of approximately $250 million. It has not yet made a firm strategic commitment to use our civilian remote-sensing assets as part of an integrated national security system.

Second, the United States evidently failed to grasp that its monopoly on civilian Earth-observation capabilities was rapidly coming to an end. The French shattered this illusion in 1986 with the launching of SPOT-1. With its advance resolution capabilities, SPOT was able to collect increasing amounts of military intelligence as well as the environmental aspects matched by Landsat.

In still another development, the Soviet Union's entrance into the commercial remote-sensing market was a watershed event. It also recently changed its policy and officially

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embraced the French proposal to establish an international satellite monitoring agency, a concept that both the United States and the Soviet Union helped table at the U.N. in 1978. In my opinion recent Soviet overtures in this area have less to do with commercial remote-sensing activities and more to do with advancing their own geopolitical interests.

By the year 2000, it is projected that 24 nations or multi-national organizations will launch between 40 and 50 satellites, a development that suggests opportunities for international cooperation are quite numerous. We will have entered a new era in remote-sensing of the Earth. Data formerly available to intelligence agencies is now widely available in the open domain.

With the information age exploding around us, nations of all ideological persuasion are moving inexorably into an era of international openness. Global developments are also numerous and pose new challenges to U.S. national security. Global change includes a host of interrelated concerns such as the environment, sustainable economic development, overpopulation, desertification, the proliferation of nuclear weapons and ballistic missile technology, the spread of chemical and biological weapons, and the growth of the international marketplace.

Further, the Soviet Union claims to be in the process of rethinking its global strategy. All told, the United States is once again in a position where we must understand the extent of modern-day global changes and challenges so an appropriate national strategy can be fashioned. An extensive data base is required if we are to embrace and make the most of these changes. Images acquired by Landsat represent one important data base and this will continue to grow over time through the present satellites in orbit and with the launch of a more advanced Landsat 6. If we turn off Landsats 4 and 5, we could be setting ourselves up for a major strategic disaster.

A CORE NATIONAL SECURITY STRATEGY

The global challenges nations now and into the future face are manageable. If our nation is to face these challenges, however, we must have an integrated national security

strategy. Far too often, national security is interpreted to mean military might only. The projection of military power is a crucial element of national strategy, but not the only one. An effective national strategy is the bringing together of all our nation's assets, particularly economic resources and public perceptions of truth, in a way that promotes our interests in both the short and long term.

For the purpose of this testimony, I would like to suggest ways in which our civil remote-sensing operations, in particular Landsat, could become part of our national security strategy. I strongly believe that this step must be taken or else the probability is quite high that you will hold a similar hearing next year, with the United States falling behind in this crucial information processing technology. Only then you will be discussing the demise of Landsat 6. Today's funding shortage is a symptom of a larger problem.

Making this step does not mean that our commercialization efforts must stop. On the contrary, they should continue. Cooperative efforts should also be encouraged as long as they are part of a well integrated strategy. As a side note, herein lies the real harm of NOAA's attempt to strike a bargain with the French. Not only did they fail to inform other government agencies, and EOSAT, of the negotiations, but more importantly, as a nation our remote-sensing policy has not yet progressed to the point where cooperative ventures can profitably be pursued.

It is fair to say that EOSAT has not only been constricted by funding restraints, but more importantly, policy constraints. Both the President and Congress have attempted to micro-manage an instrument that is inherently global in nature. When Landsat images the Earth, it detects all features of society, not just civilian or military ones. Moreover, only a small portion of the time does Landsat image U.S. territory. It is, therefore, de facto an international instrument.

The conceptual framework for including Landsat as part of our national security strategy is surely a revised version of President Eisenhower's "open skies" proposal. The outlines of the operational strategy can be found through surveying Landsat's international ground stations, many of which are located in key geopolitical regions of the Earth.

A revised open skies policy can be achieved without undercutting our national intelligence and defense operations. The establishment of an institution similar to NPIC operating in the public sector is essential to accomplishing this goal. In my opinion, EOSAT has all the potential to be that organization. Second, a slight up-grading of the Landsat orbiter by providing it sensors that resolve images of the Earth to picture objects with dimensions of 3 to 5 meters, along with regular use of today's thematic mapper, is in order if we want the public to monitor and understand most global developments.

Intelligence of military interest gathered in this manner should not be directly associated with arms limitations treaty verification. International arms control treaties unfortunately have very rarely influenced the international behavior of nations. Official intelligence agencies can monitor compliance with treaties as well as it is possible to do. However, open knowledge of military, economic, and environmental facts on a world-wide basis would go a long way toward increasing international security and stability.

An operational strategy to exploit any international arrangement should start with the ground stations. It is imperative that such an arrangement focus on monitoring the environment and the usage of natural resources and serve peace-keeping goals only in a supplementary way. Nonetheless U.S. government aims in peace-keeping will derive substantial benefits from an effective instrument of civil information processing. In the future, wars may well be fought over resources such as water or acid rain. Landsat's ground stations cover most of the geopolitical hotspots where conflicts may arise. A conceptual framework for an international arrangement has been spelled out in great detail by Dr. John McLucas and Dr. Paul Maughan.

Whether nationally or internationally, open skies could be phased in over a period of time as long as ten years, making the whole undertaking comparable to President John F. Kennedy's commitment to reaching the moon by the end of the decade. Open skies would be a positive modern strategy capable of increasing the security of the United States and all nations while reinforcing commitments to defensive military strategies pursued by the great powers.

Congress can play a critical role in promoting a revised open skies policy. Last Congress, Representative Robert Mrazek introduced a bill that would go a long way toward developing a revised open skies policy. It did not attract much attention last year, but given recent developments, it is extremely timely. I strongly supported last year's legislation and it is my understanding that the bill has been revised and will soon be reintroduced. I encourage all Members to examine closely this legislation as a valuable input to developing a sound approach to remote-sensing of Earth.

CONCLUSION

As you can tell from my testimony today, my interest in the Landsat program is primarily from the perspective of the role that open information and public diplomacy will play in strategic security planning. That does not mean I value any less the commercial aspects or cooperative endeavors. A fully integrated remote-sensing policy will involve all of these factors and combine them into a strategy for peace, economic development, and environmental quality.

The stakes we are playing for today are quite high. How high you might ask? An old colleague of mine, Arthur Lundahl, the legendary first director of NPIC, has phrased it in this manner: "Astronomers tell us that the further outward we look into space, the further backward we reach into time. Photo interpreters tell us that the more often satellites look downward at Earth, the more data we can accumulate for projecting the images of the future on Earth."

So, whatever it takes, I hope all the parties present today can resolve their differences and fund the operations of Landsats 4 and 5 for the remainder of FY 1989 and as long as the satellites last. They are a small but significant part of an ongoing information-age policy of peace, security, prosperity, and environmental safety. Once we confirm the importance of keeping Landsats 4 and 5 in operation, we should begin exploring the larger policy options before us. If we cannot make these small steps in support of the Landsat programs, the future of spaceship Earth is in doubt. Surely, $10 million is not much money to spend when you look at the larger global picture. If we do not understand that basic fact, we will not be part of the solution of a sound future for our planet, but regrettably part of the problem.

Mr SCHEUER. Thank you very much, Dr. Cline.

And now Dr. Mark Settle.

Mr. SETTLE. Mr. Chairman, thank you very much for the opportunity to be here today. I represent private sector users of Landsat data, and what I'd like to do is just reinforce some of the points that have been made earlier in the discussions that we've heard this afternoon.

I'd very much like to reinforce your point that we are dealing with a technical success. The failures in this program are related to the management of the program and not at all the technology that's involved.

The other point I'd like to reinforce is that we've only scratched the surface as far as the commercial utility or applications of the technology. We've gone back and looked at the way we used to do business and found ways that Landsat can be used to help us do what we already do a little more efficieinternationaly or a little more effectively. But I'm convinced, as are many people in the private sector, that this is going to open up a whole lot of new opportunities that we've never really even thought about before, and that's the real up-side potential of this technology in the future.

We've sunk the development cost. We have the opportunity to capitalize on those costs and seize that economic potential. This is not the time to break the bond, if you will, with the private sector and just let this opportunity go drifting away from us nationally. That's our biggest concern.

[The prepared statement of Mr. Settle follows:]

STATEMENT OF
DR. MARK SETTLE
MANAGER, INTEGRATED EXPLORATION RESEARCH
ARCO OIL AND GAS COMPANY
DALLAS, TEXAS
AND
CHAIRMAN, BOARD OF DIRECTORS
THE GEOSAT COMMITTEE
NORMAN, OKLAHOMA
TO THE
SUBCOMMITTEE ON NATURAL RESOURCES,
AGRICULTURAL RESEARCH AND ENVIRONMENT
OF THE
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
MARCH 7, 1989

Mr. Chairman and Members of the Subcommittee:

I am pleased to have an opportunity to discuss the issue of Landsat 4 and 5 operations with you and the members of the Subcommittee. I am here today in two capacities: I am representing my personal views and those of my company, Atlantic Richfield(ARCO). I am also representing the Geosat Committee, a nonprofit organization that promotes the use and development of remote sensing technology for purposes of resource management. ARCO is a longstanding member of the Geosat Committee and strongly supports its objectives. On behalf of Geosat's member companies I would like to thank you for this opportunity to place our views on record.

I have come to testify on behalf of continued operation of Landsat 4 and 5. I am a routine user of Landsat data. In fact, I am one of thousands of individuals in this country who are actively exploiting Landsat technology for practical, commercial applications.

The sensor systems carried on Landsat 4 and 5 provide a radically different way of mapping and monitoring surface conditions on our planet. The information they provide may potentially revolutionize the way we explore and manage our natural resources. Unfortunately, revolutions take time. The transfer of fundamentally new technology from research Landsat 4 and 5 operations will stymie this process, and make it easier for other nations to capitalize on technology that was initially developed within the United States.

Mr. Chairman, I would like to provide you and the other members of the Subcommittee with a little more insight into how Landsat data is used within the private sector by describing the uses of such data within my company. I work for Atlantic Richfield, a vertically integrated oil and gas company that operates in the United States and abroad. I specifically work at ARCO's Plano Research Center in Texas where we have specialized computer facilities that enable us to enhance, analyze, and interpret Landsat data. We use Landsat imagery in two different ways. It's used on a routine basis to detect crustal structures such as folds and faults that may serve to trap hydrocarbon accumulations at depth. It's also used as a research tool to develop new methods of detecting alteration effects at the Earth's surface that may be produced by the vertical seepage of hydrocarbon gases. This latter application represents a potentially revolutionary means of prospecting for oil and gas deposits. It could provide ARCO with a highly leveraging means of finding oil situated in stratigraphic traps which have no structural expression at the Earth's surface.

Why bother to keep Landsat 4 and 5 in operation? Don't geologists already have enough data to keep them happy? The answer is categorically no! The structural mapping studies we perform with Landsat data are based upon the analysis of surface landforms. Folds and faults are expressed at the Earth's surface by the occurrence and/or alignment of certain landforms such as hills and escarpments. They can also be expressed by the orientation of drainage features such as streams. Landform and drainage features tend to be relatively stable. They don't change shape or position to any significant degree over human time scales. However, their expression at the surface may change dramatically due seasonal variations in vegetation cover, crop cultivation practices, and rainfall It's also important to realize that Landsat Thematic Mapper data has never been acquired over some parts of the world. The first successful launch of the Space Shuttle following the Challenger disaster placed a new Tracking and Data Relay Satellite(TDRS) into orbit. This satellite will enable us to acquire Thematic Mapper imagery over many parts of Asia, Australia, and the western Pacific for the first time. We expect that Thematic Mapper data will provide significant new insight into the crustal structure of such areas as China, Pakistan, southeast Asia, India, and Australia. This information will enable ARCO and other companies to better assess the hydrocarbon potential of these regions. This information, in turn, will allow us to make strategic decisions about where to focus our exploration efforts overseas for years to come.

Earlier in my testimony I indicated that we are also conducting research at ARCO concerning the use of Landsat data for detecting hydrocarbon-induced alteration effects at the Earth's surface. This research has indicated that subtle variations in the health of vegetation may be correlated with the local presence of oil and gas. Vegetation stress effects associated with hydrocarbon seepage may only be expressed during certain seasons when other stress agents such as drought and nutrient deprivation are also operative. In short, we don't fully understand the seasonal conditions that provide the best expression of hydrocarbon-induced stress in natural vegetation. We have a continuing need for Landsat imagery to determine the circumstances under which these effects can be identified.

Why be concerned with acquiring additional Landsat data when other satellite systems such as SPOT are also available? Isn't SPOT imagery effectively equivalent to the type of data acquired by Landsat? Again, the answer is categorically no! Landsat has been designed to acquire imagery within specific spectral bands that don't exist on the SPOT system. In addition, Landsat provides regional synoptic views of the surface that cover broad swaths 100 nautical miles in width. SPOT images cover much smaller areas and must be mosaicked to obtain a regional picture of specific areas. These differences may seem subtle, but, in fact, they have significant implications for users. Most users now agree that Landsat and SPOT are complementary in nature, and that best results can be obtained when the two different types of data are merged for analysis.

Mr. Chairman, I suspect that my situation at ARCO is very similar to that of many other commercial users. There are some things that Landsat data can be used for today. It can improve the effectiveness and efficiency of the way we currently go about our normal business. At the same time, most users are conducting research to explore alternative applications of Landsat technology. As we like to say in my industry, the "upside potential" of this research is enormous. It could have a major impact on the way we explore for oil and gas, monitor topsoil loss, optimize crop cultivation practices, detect the environmental consequences of industrial pollution, manage water resources, etc. This research will simply not be performed within the private sector without an assured source of orbital data. Without continuous operation of Landsat 4 and 5 and follow-on sensor systems, the United States will fail to reap the economic benefits of a technology that has been developed by the Federal Government over the past 15 years!

I am a geologist by training and in the short time available today I have only been able to describe some of the geological applications of Landsat technology. However, Mr. Chairman, we could easily fill this room with farmers, foresters, land managers, city planners, hydrologists, and others who would basically tell you the same story. There is a small army of individuals in this country who, at their own expense, are trying to develop commercial applications of Landsat technology. I think I speak for all the members of this "army" when I tell you that we have only "scratched the surface" in terms of realizing the potential commercial benefits of this technology.

Failure to maintain a steady stream of Landsat data will have both short term and long term consequences. In the short term, it will make my job much more difficult. I will have to tell members of our operations staff in Indonesia, Australia, New Zealand, and China that no, we will not be able to assist them in their ongoing exploration efforts. Perhaps more importantly, the failure to continue Landsat 4 and 5 operations will erode my ability to conduct meaningful research into new applications of Landsat technology. How can I study retrospectivel find the long term consequences of the decision to terminate current Landsat operations to be quite unpleasant. Under the <u>best possible circumstances</u>, ARCO will continue its efforts to exploit satellite technology; however, it will do so by becoming reliant on foreign countries for an assured stream of satellite data. Under the <u>worst case scenario</u>, we will gradually abandon our research in this field and leave it to others to exploit the commercial benefits of a technology that was initially developed within the United States. I think that the kinds of decisions that ARCO makes in this regard will occur in many other organizations as well.

In summary, Mr. Chairman I am very disturbed by NOAA's plans to terminate Landsat 4 and 5 operations. I think that the decision is very short sighted. From the vantage point of Texas, which is quite a ways west of the Potomac, it seems to me that this is a classic case of a Federal agency creating, not implementing, Government policy. The decision to terminate Landsat operations represents a major redirection of Government policy in the area of space commercialization. It puts the Federal Government on record as a "bad faith" partner in future dealings with the private sector. Furthermore, it effectively "hands over" the commercial benefits of a homegrown technology to our foreign competition. I don't find either of these developments compatible with the stated objectives of our national space program.

Mr. Chairman, I would like to suggest that we are basically on the right track. The Federal Government displayed a considerable degree of foresight and vision when it initiated the Landsat program in the early 1970's. The program is a classic example of a large, capital-intensive development project that cannot be cost-justified within the private sector. The current challenge is to see the program through to its logical conclusion. Let's give the Remote Sensing Commercialization Act a chance to work. Let's continue to provide the private sector with the continued access to Landsat data that it needs to develop viable commercial applications of Landsat technology. I personally believe that the ultimate commercial payback of this technology will more than outweigh the sunk development costs that have been expended to date. Let's not fail to realize this payback by "saving" the funds required for continued operation of Landsat 4 and 5.

I respectfully recommend, Mr. Chairman, that the resources be found to continue Landsat 4 and 5 operations into the immediate future. Furthermore, Mr. Chairman, I recommend that the U.S. Government formally commit itself to maintaining a steady stream of Earth resources satellite data through the end of the 1990's.

STATEMENT OF
DR. FREDERICK BRADLEY HENDERSON III
PRESIDENT, THE GEOSAT COMMITTEE, INC.
NORMAN, OKLAHOMA
SUBMITTED TO THE SUBCOMMITTEE ON
NATURAL RESOURCES, AGRICULTURE RESEARCH AND ENVIRONMENT
OF THE
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
March 7, 1989

Mr. Chairman and Members of the Subcommittee:

I am pleased to have been invited to appear before these hearings on the termination of Landsat 4 and 5 on behalf of the Geosat Committee, Inc., its member organizations, and many supporters in the field of land satellite remote sensing. While I am unavoidably out of the country on March 7, Dr. Mark Settle of the Atlantic Richfield Company (ARCO) will testify for me on behalf of the Geosat Committee, Inc. In addition to his present role of Manager, Integrated Exploration Research at ARCO, Dr. Settle also serves as the Chairman of the Board of Directors of the Geosat Committee, Inc. I have prepared a written statement on the Committee's behalf. Dr. Settle will provide additional testimony on the importance of continuing the Landsat Program from the perspective of a major industrial user.

The United States is again running the risk of losing yet another U.S. technology to other countries more able to capitalize on commercial application of U.S. research and development. France, Japan and others around the world are rapidly developing civil land observing satellite systems to meet their national economic and security needs. These systems will provide such countries with a secure source of domestic and global resource intelligence and environmental information. The U.S. Government presently shows no understanding of the importance of assuring a secure U.S. source for such information. Apparently, this is because U.S. Government needs can be met by classified means and U.S. civil needs be damned if they can't be served commercially by the private sector.

The U.S. Landsat program, brilliantly established by NASA, is stymied because of the Reagan Administration's premature and abrupt push into commercialization by the Department of Commerce/National Oceanic and Atmospheric Administration and the Office of Management and Budget before a viable market was established. A further hindrance to the Landsat program has been the absence of continuing Government commitment to its development because of a lack of Government vision of the operational U.S. Landsat technology as a long range national U.S. asset. This has been demonstrated of late by the nonexistent DOC/NOAA leadership to place a high enough priority on the Landsat Program to aggressively pursue its original contract with EOSAT to operate Landsats 4 and 5 and build Landsats 6 and 7.

Now, for "budget reasons", NOAA is terminating the operation of Landsat 4 and 5 on March 31, 1989. This decision has been made in spite of the fact that these satellites are operating beyond their three year design lives to fill the data gap until Landsat 6 is belatedly launched in 1991. Termination of Landsats 4 and 5, while still operational, seems even more ludicrous while NOAA is still spending money to build Landsat 6. To further confuse the issues of NOAA's intentions, NOAA has yet to release for public consideration their recommendations regarding an advanced civil earth remote sensing system beyond Landsat 6 as requested by Congress in 1988.

The Landsat system serves as a national asset because it jointly benefits public, national security, and foreign policy interests of the United States, provides long-term monitoring capabilities for growing U.S. and international environmental studies of Earth systems and global change, provides the U.S. economy with global resource intelligence necessary for U.S. competition in the world marketplace, and serves to stimulate U.S. technological commercial opportunities at home and abroad.

The reasons for maintaining a U.S. Landsat program serve the public good as well as the private sector. They are clearly understood in other countries which are developing their own satellite capabilities with continuing government support. These countries presently include France, India, Japan, the U.S.S.R., and will soon be followed by Brazil, Canada, China, Germany, and the European Space Agency. Isn't it ironic that operational civil programs can be supported by these countries, but the U.S. program where the technology originated is in difficulty. Perhaps one reason is that these countries, unlike the U.S. Government, do not possess established classified systems to internally serve their government needs. Another major factor is that the governments in these countries collaborate with the user industries in developing satellite programs because their overall national economic agendas are mutually supportive. This in stark contrast to the way the U.S. Government is forcing the survival of the Landsat program on yet unproven arguments of private sector commerciality.

What are the short-term losses if NOAA prematurely terminates Landsat 4 and 5? From the point of view of acquiring global economic resource intelligence and environmental data for global change studies, one to two years of continuing coverage will be lost. Moreover, over a third of the world has just become visible to the Landsat Thematic Mapper System with belated start up of a second TDRSS communication satellite over Asia and Australia. We need Landsat TM coverage of these areas to complete global coverage before the satellites wear out on their own. In terms of international competition, the U.S. government is showing bad faith to the international ground receiving stations now receiving Landsat data and to their users. It is another example of the untrustworthiness of the U.S. satellite remote sensing policy as seen by the rest of the world. For example, the unfortunate Pakistan station has just acquired the capability to receive Landsat TM and wonder why the U.S. is abruptly turning off their source only weeks after their start up. No wonder Pakistan enjoys dealing with the French SPOT program, which promises continuity. It is even more puzzling to witness DOC/NOAA cutting off the funding for Landsat 4 and 5 when they are supposed to be in the vanguard of the Reagan and now Bush Administrations' efforts to commercialize space. However one might judge the efforts of EOSAT, the government has been an unreliable partner in their contract with EOSAT to privatize and then commercialize the Landsat program.

The future of this U.S. technology asset will be determined largely by the Bush Administration. The Bush Administration, along with Congress, must first determine whether continuity of civil land observing satellites is in the U.S. national, public and economic interests to be worthy of further Government support. The future of this technology cannot be the responsibility of U.S. commercial industry along. Links between continued remote sensing basic research by NASA, now shared with other countries, must be strengthened with the U.S. user industry and commercial developers. The long-term issues must be carefully deliberated jointly by the government and by the private sector, perhaps with the help of newly constituted National Space Council under Vice President Dan Quayle.

In the short-term, however, there are three actions that must be taken immediately:

1). Ten million dollars must be found now within NOAA or Congress to avoid shutting down the operation of Landsat 4 and 5 by March 31, 1989. Perhaps this is an area where the Department of Commerce and the Congressional appropriations committees could demonstrate greater cooperation as promised by the Bush campaign;

2). Support must be found for full 1989 budget funding to complete the 1988 Department of Commerce/EOSAT Landsat contract to finish the construction of Landsat-6;

3). The 1988 Congressionally mandated NOAA contractor studies for a system to follow Landsat 6 just released for these hearings by NOAA and OMB should be broadly disseminated to the public. The 1989 NOAA Action Plan should also be released as soon as possible and not bogged down in NOAA and OMB obscurity. Public release of these documents will provide for informed Government and private sector dialogue to assist the Bush Administration, Congress and the private sector in finding a workable advanced civil earth observation system that is competitive, commercial, and able to serve the long range national economic and security interests of the United States.

Mr. SCHEUER. Thank you very much, Dr. Settle.

And I would take it you would include in the enormous potential of this technology not only the economic potential for private users but the global environmental monitoring potential that Dr. Rock discussed, the intelligence and——

Mr. CLINE. Security.

Mr. SCHEUER. And security potential that Ray Cline discussed. There's a whole galaxy of constructive uses flowing from this information.

Mr. SETTLE. Yes, sir.june 3, 1989. -Subformat:

Mr. SCHEUER. Okay. Now we'll hear from our last witness, Dr. William Bishop.

Mr. BISHOP. Thank you, Mr. Chairman. I, too, like Don Latham, have testified before your committee, but then as a Federal official trying to commercialize Landsat. Now, I come to you from academia and——

Mr. SCHEUER. We forgive you for what you've—[Laughter.]

Mr. BISHOP. Thank you, sir. I come to you now from academia, but more importantly probably as a conduit from The Keystone Center in Colorado. I am on their Board of Trustees and their representative today, in reality.

I have a brief statement for the record, and also would like to submit for the record the report of The Keystone Center that Mr. McCurdy referred to earlier. Right now I'd like to only make a few of the key points that were made in that report.

First of all, at that time we did not access to the reports that NOAA commissioned, which I believe are the first realistic report on the commercial capability of Landsat, and I commend NOAA for finally getting those out on the record for us. But we did have in our meetings some of the leaders of the three teams who made those reports, so we could consider it.

I don't believe that we came up with anything new in that meeting. We did reaffirm some things and, perhaps, articulated them differently. We did reaffirm the fact that it is important to continue Landsat for all the reasons that you gentlemen and the other witnesses have said today. They are simply that it's important for studying global change, the scientific and policy implications of that. It's important for our competition globally in business, and it's important as a tool for global economic intelligence. And you gentlemen and the witnesses touched on all of those things today.

We came up with 3 recommendations in that report, and I'll merely list them.

One is that the government continue its commitment to Landsat 4-5, to the archive of the Landsat data, and to the building of Landsat 6. These are the immediate things.

Secondly, that the private sector, like we witnesses before you now, document carefully for you gentlemen and others the real reasons why Landsat is important. We did not feel that this has been done in an organized way.

And, finally, in the long term, that we reconceptualize this deal we have between the private sector and the government, something that you've been talking about, sir, doing in the near future.

Finally, we took a look at the institutional arrangements in that couple of days in the mountains in Colorado and came to the con-

clusion that there is a great lack of leadership, and it's the section that Mr. McCurdy again referred to, "Who's in Charge Here?" We made a call in that report, perhaps a little bit too late since it was just published, to have the Space Council take some at least re-emerging leadership, and it sounds from this morning's newspaper like that may be happening.

And we also called for—we looked at who could best be in charge and we came to the conclusion once again that it's probably NOAA in the role that Mr. McCurdy articulated so well as "handing off the baton."

So, finally, let me add my voice, as I probably have before, to the others in this room encouraging you, sir, and the Administration to continue the Landsat effort. It's an important asset.

[The prepared statement of Mr. Bishop follows:]

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STATEMENT

Regarding the Proposed Termination of Landsat 4 and Landsat 5

before the

Subcommittee on Natural Resources, Agriculture Research
and Environment
of the
Committee on Science, Space and Technology

Tuesday, March 7, 1989

by

Dr. William P. Bishop
Vice President for Research
Desert Research Institute
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and
Member of the Board of Trustees
The Keystone Center

Mr. Chairman, I am delighted to be here to share my thoughts regarding the Landsat system. I am not particularly pleased to be here under the current circumstances, where the U.S. is facing an imminent loss of our land remote sensing capability

I come before you today not only as a knowledgeable individual but as a member of the Board of Trustees of the Keystone Center, in Keystone, Colorado. For almost fifteen years, The Keystone Center has called together groups of concerned individuals to discuss issues of societal concern that have a heavy scientific or technological content. The Center has had considerable success in drawing out consensus among those of widely differing viewpoints on issues such as hazardous wastes, energy policy, biotechnology and others. The Center calls this program "Science and Public Policy", and it has earned a considerable reputation through its effort.

Last autumn, in anticipation of the current situation with Landsat, several of us urged the Center to undertake a "dialogue" on Landsat. The Center agreed, and the Frontiers of Science Foundation of Oklahoma provided funding for the meeting. We assembled a remarkable group of people for a day and half. I have submitted the report of that meeting for the record. I will merely summarize its major findings as a part of my remarks along with a few of my own views to amplify on some of the Keystone themes.

While the Keystone group did not have access to the recently released reports on the future of Landsat commissioned by NOAA, we did have in the room key people from the contractors who prepared those reports. We therefore knew that all three of the studies concluded that the system would not be self sustaining financially in the usual commercial sense for many years -- considerably beyond even the life of Landsat 6. Therefore, if we are to continue a Landsat program it will require additional government support.

In reality, that should be no surprise, since the original bids in 1984 for the "commercial" system under the 1984 Act (PL 98-365) envisaged the need for government support for ten to fifteen years. Further, the initial "deal" struck with EOSAT encompassed that period and two satellites. What the studies contribute is a careful and (for the first time) realistic analysis of the financial situation surrounding Landsat. The Keystone group individually and as a group has urged the prompt release of those studies so that the issue of what policy to adopt in the face of the realistic financial basis can be adequately addressed. But, because we knew the overall conclusion of the studies, we could still proceed to discuss policy options.

The Keystone group found that there are powerful reasons of the "public good" that argue strongly for continued government support of Landsat. They were three:

1) Landsat is a powerful and, in some ways, unique tool for the study of global change.
2) Landsat has made and can continue to make a strong contribution to U.S. international competitiveness.
3) Landsat is a unique tool for global economic intelligence.

We argue that the government should continue its support for these three reasons.

Based on this overall conclusion, the Keystone group outlined several recommended actions. Key among these were:

- In the near term, the government should continue to support the operation of Landsats 4 and 5, support the maintenance of the national archives, and support the development of Landsat 6. All three components play together in the remote sensing game, and no one or two of these elements provides a reasonable program.
- The users of Landsat should publicly document the benefits of Landsat for the "public good." It is clear now, with 20/20 hindsight that we were blinded by the promise of commercial success, and that the commercialization attempt was both too soon and too abrupt.

In my mind, perhaps the most serious problem we identified in the Landsat program is an almost incredible lack of leadership. In the very tight budget times, NOAA seems to have abrogated its leadership role, refusing to support the continued operation of Landsat 4 and 5. Other parts of the administration seem from the outside to be ignoring the problem. There is no leadership in the private sector. In spite of the fact that there are many users, some of them represented today, there is no unified voice from them. EOSAT is hampered in exerting leadership by uncertainties over its future. Only the Congress seems willing to exert some leadership, but then only when confronted by what approaches an emergency. All of this is vastly different from the general community of interest, cooperation, and leadership among all the parties that you and I and others experienced during that period when the Landsat Act of 1984 was being drafted and enacted.

The Keystone group discussed this at some length. We decided that a nearly perfect place for some re-emerging leadership might be the "Space Council" that then candidate Bush promised to reactivate. From this morning's paper it seems that some action is occurring in that council, and I hope the government witnesses will fill us in on what has actually happened there.

In the longer term, the government and the private sector must re-think the paradigm and policies under which the program is operated. The law passed in 1984 and the deal struck then have been eroded by events of the past few years. Once we are past the current urgent problems, we should re-examine our direction for the program.

The U.S. has developed a remarkable capability in Landsat, a capability that is already being exploited for scientific and economic gain. It is a capability that is rapidly attracting other countries. Those countries (France, Japan, India and others) are willing to face the investment for the sake of their future. I fear that Landsat may represent another example of a U.S. technology that is a stepchild. Another computer chip or VCR that the U.S. fails to exploit to its fullest. We have generated the idea. We

have proven it. But we seem not to have the grit to stick with it and reap the benefits. The Japanese and French welcome the technology and seem willing to exert the hard work to make it pay off for them. I believe the payoffs will be the three listed by the Keystone group.

Finally, I find it troubling that the world cannot trust the word of the U.S. government. I say this with considerable sadness, since it was my word that was given some years ago. We assured the world that we would continue Landsat. We told the "little guys" in the U.S. that the tool would be there. We told other nations investing in ground stations that it would be there. To be fair, we told them that the rules would change, that it would be a commercial operation. But now we are about to turn off even that operation. I think that objective analysis from outside the government would necessarily conclude that the word of the U.S. government is to be taken with a heavy grain of salt.

The arguments surrounding the situation we face today are framed in terms of budget. But the amounts of money are small. It is not a question of money. It is a question of priorities. I would like to add my own voice to those in this room and those who met at the Keystone Center in argument that we should continue the Landsat system now and for the foreseeable future. We should make the commitment. We should exploit this remarkable technology for the good of the U.S. public. And we should renew the commitment that the government made in 1984 to that system.

Thank you, Mr. Chairman, that concludes my prepared remarks.

REPORT OF THE
KEYSTONE LANDSAT POLICY DIALOGUE

October 28 and 29, 1988

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SUMMARY CONCLUSIONS

We conclude that there are three powerful reasons to continue a U.S. Landsat program. All are reasons of "public good", and all argue strongly that a continued government role of some kind is justified. They are:

- Landsat is a powerful and, in some ways, unique tool for the study of global change and the many large scale environmental issues facing us now and in the future.
- Landsat has and can continue to make a strong contribution to U.S. international competitiveness.
- Landsat is a unique tool for global economic intelligence.

The arguments substantiating these assertions have not been mustered in a convincing manner. While we make a first attempt below, this conclusion also leads to several actions in the near and longer terms.

The U.S. Government must continue its support of Landsat if there is to be a U.S. program. This support must take two forms--financial support and policy support to keep a level "playing field" with the foreign competitors (currently, the French, Japanese, and Indians to be followed soon by Canada, European Space Agency, and others). This conclusion also leads to some recommended actions.

We feel that the private sector must take a much stronger role in justifying the continued program on the basis of these national needs. The problem with government support of the program in the past has been characterized as a budget problem. It is not. On the scale of national budgets, the Landsat budget is significant but small. More correctly, the problem is one of priorities. We discuss below some aspects of this need for private sector action and some recommended government actions as well.

Finally, we conclude that there are specific government (and private sector) actions needed in the near term and in the far term, and that they are qualitatively different for those two periods. In the near term, the government should continue to support operation of Landsats 4 and 5, maintenance of the national archives and the development of the planned and expected Landsat 6. The private sector (and government) users should

publicly document the benefits of Landsat. In the longer term, the government and the private sector must re-think the paradigm and policies under which the program is operated, investigating a number of approaches that we enumerate in Appendix A.

I. INTRODUCTION

As part of its continuing series of dialogues on science and public policy, the Keystone Center convened a meeting on October 28 and 29, 1988 to discuss the future of Landsat. The attendees (see Appendix B) represented a diverse group who were concerned about the future of Landsat.

Impetus for the meeting was provided by the recently completed studies commissioned by the National Oceanographic and Atmospheric Administration (NOAA). While they are not yet released, it is common knowledge that they all conclude that the Landsat system will not be a self-sustaining commercial enterprise within the immediate future with even the most optimistic revenue projections.

As detailed in the Declaration presented below, the discussions were based on the belief that the Landsat program is an important one to be maintained and sustained. The group met to focus on two specific issues:

- The need to continue Landsat -- while we believe that it is in the national interest to continue a U.S. system, the reason must be clearly articulated.
- The actions that the U.S. Government might (or should) take in the near term and longer term -- the choices are manifold (see Appendix A for examples) and different in the near and longer terms.

We discussed most of these diverse ideas and reached a succinct set of conclusions set out below and elaborated in subsequent sections of this report.

II. DECLARATION FROM THE KEYSTONE GROUP

On the threshold of the twenty-first century, global resource utilization, environmental change and expanding world population are becoming critical issues with broad ranging political, social, and economic implications. For over twenty-five years, the U.S. has been at the forefront of developing technologies to observe and study our planet from space.

No modern leading society can adequately prepare for the future without the technologies for quantitative monitoring of the earth's system and its changes. This is a responsibility of government and industry that is in the public interest and which will stimulate the growth and development of the private sector.

Essential to earth observations are satellite sensors which provide continuous highly repetitive, synoptic data which permit quantitative analyses down to local scale. For sixteen years, Landsat observations have provided data permitting analysis of natural resources and environmental conditions on a worldwide, seasonal basis. This continuously acquired data represents a national asset for understanding human activities and the resulting global environmental changes. No other system provides data with the regional synoptic perspective, the high spatial and spectral resolution, and the historical perspective of Landsat. It is in the national interest and general public good to ensure that Landsat data collection is maintained in an uninterrupted fashion and that new technologies are introduced to ensure that the U.S. remains at the vanguard of earth observations from space.

III. WHY CONTINUE LANDSAT?

The declaration above states our position in the simplest terms. We believe that Landsat is an important tool, perhaps key among the many available to us on three fronts. Landsat allows us to observe and measure our planet on global scales. Landsat is one important source of economic intelligence data, again on a global scale. Finally, Landsat is both an example of and supportive of our international economic competitiveness.

A Major Tool in Understanding our Global Environment

Environmental questions are of increasingly critical national and international concern. Global changes are occurring as a result of human activity. Many of these issues transcend national boundaries and can only be addressed by the concerted efforts of many nations. The information technologies required to effectively address these issues must be global in nature and must provide intelligence on the interrelations of the various environmental systems. Since many of these effects require a historical perspective and involve small changes over long periods of time and large areas, long term, consistent, objective measurements must be made of the critical variables. Global space observations systems are particularly suitable to meet these information needs.

Landsat makes a unique contribution to the study of these phenomena. It gives a much closer look than the meteorological satellites, while it provides more regional coverage with greater spectral information than the French Systeme Provatoire d' Observation de la Terre (SPOT) system. But most importantly, it provides a continuity at a crucial spatial scale over the past couple of decades. Over the last sixteen years, the U.S. has accumulated an invaluable asset in Landsat data for long term resource and environmental observations. This historical data base is a priceless asset to compare to future measurements in establishing long term environmental trends and impacts.

Landsat data will also be important in addressing other topics of critical national importance and public good (e.g., global strategic mineral and resource assessment, addressing international disputes, monitoring and enforcing environmental regulations, the war on drugs, humanitarian aid and assistance to developing nations and providing an information tool for more efficient industry operations through better economic intelligence).

Although there will be many opportunities for contributions to these issues by the private sector, only a continuing government commitment to a consistent flow of compatible data will permit

the long term issues to be successfully addressed. The fundamental beneficiary of all of these activities will be the U.S. public at large. Therefore, assurance of the continuity of these data is a continuing national need. One critical component of this technology, whose continuity must be assured, is the Landsat series of monitoring satellites.

If properly preserved, the sixteen years of Landsat Multi-Spectra Scanner (MSS) data is, in many ways, the ideal data set for monitoring and assessing global environmental change, particularly those changes that are induced by man (e.g., agriculture, deforestation, desertification, urbanization, etc.). It is the first and still the only truly global data set with sufficient spatial and spectral resolution to detect many of the changes of concern. The historical nature of the data set (sixteen years) is crucial to assessing the rate and the degree of environmental changes (growth of deserts, shrinking of water bodies, etc.), which in turn is critical to predicting future trends.

The very scope of the problem requires digital analysis and management of the data. Historical analysis of environmental changes is greatly facilitated if the data sets acquired at various times are identical or at least compatible in terms of resolution, look angles, scan line orientation and sun angle. The Multi Spectral Scanner (MSS) data set is very rich, historically, in that not only are there multiple coverages through time, but there are also multi-seasonal coverages for the same year.

In short, for a data set to be useful for comprehensive environmental assessment and monitoring it must be:

- global;
- have repeat coverage through time;
- have sufficient resolution (spatially and spectrally) to detect crucial elements and indicators;
- be digital; and
- have the same format through time or at least be compatible.

We have been assured that useful SPOT data, such as stereo, regional revisit, high resolution data, with essentially the same characteristics will be acquired for the next eight to twelve years. However, SPOT does not provide an optimal data set for global environmental assessment for several reasons:

- SPOT provides less material sensitive spectral information than Landsat Thematic Mapper (TM).

- SPOT does not provide historical perspective. A global set of SPOT data is yet to be acquired and quite likely will not be acquired for several years because of smaller aerial coverage per orbit and cloud cover.

- It is comparatively expensive to use SPOT data for global assessment. SPOT requires roughly nine times as many images on different orbits to cover the same area as a single Landsat MSS or TM image. Each SPOT image costs roughly twice as much to purchase and to process as an MSS image. Thus, there is an almost 15:1 cost factor for SPOT coverage equal to a single Landsat TM scene.

- Besides the cost, the restricted size of SPOT coverage means there is almost an order of magnitude increase in edge-to-edge variance by virtue of time of acquisition with SPOT over MSS because of the increase of orbital passes needed to provide the same areal coverage.

- Digital comparison of SPOT with MSS requires more processing cost than comparison of two MSS scenes or MSS and TM scenes.

Economic Intelligence and International Competition for Global Resources

Economic intelligence is fundamental to successful competition and participation in world trade by government and international industry. As with most industrialized countries, the United States' economy is dependent on intelligence about and access to basic global energy, minerals, agricultural, forestry and fishing resources.

As the world's experience with establishing methods to utilize satellite remote sensing for global resource information and development has grown over the last sixteen years, it is hardly surprising that the major industrialized countries of the world have or are developing their own national satellite remote sensing systems.

In the development of economic intelligence for global resources from satellite remote sensing, open and timely access to data can be of critical importance. Most exploration efforts center around acquiring competitive land positions. International resource companies utilize satellite remote sensing most effectively in underdeveloped countries because satellite data often provides basic mapping data not available in such

countries. Examples of this were the exploration for and discovery of petroleum in Sudan (Chevron) and Papua, New Guinea (Landsat Sudan and Landsat/SLAR programs) and on-shore geological studies in preparation for bidding for offshore concessions from The People's Republic of China in the early 1980s. Similarly, timber companies, such as Weyerhauser, are interested in monitoring international timber operations as they affect world trade in timber products.

In countries that operate satellites, government supports the development of the use of satellite data by their national resource companies or agencies in their efforts to provide energy, mineral and renewable resources needed by their national economies. In the U.S., however, government and industry interest and priorities for satellite systems and global resource information are separate. The U.S. lacks government/industry mechanisms to set common global resource requirements and support satellite techniques to acquire useful economic intelligence on global resources. Unlike other countries that operate satellites, the U.S. government and industry goals are not only not coordinated, but are at odds. This lack of concerted effort places the U.S. scientific, industrial and foreign assistance establishments at extreme competitive disadvantage.

Economic intelligence on important global resources provided by remote sensing satellites clearly is to the advantage of both the U.S. government and its industries competitive in the world marketplace. To maintain our source of timely and direct global resource economic intelligence, the United States must have a continuing civil/land/ocean remote sensing system to remain competitive in world trade for global resources.

A Major Contributor to International Competitiveness

Landsat is an example of how U.S. technology can take the leadership in an area and cause other countries to follow suit. Since 1972, the U.S. has orbited land observing satellites of ever improving capabilities. A small market for the products of these satellites has grown up internationally. Developing and industrial nations now recognize the contributions made by Landsat and have ground stations (at a fee paid to the U.S.) to receive the data over their own territories. The U.S. has pioneered this new endeavor.

Now, the French have come to the business with a government subsidized system of their own called SPOT. The Indian government has launched a MSS-type satellite for their own national interests. The Japanese will soon launch still another advanced land remote sensing satellite. The Soviet Union has entered the "marketplace" with photographs from one of their

intelligence satellites. All of these compete, in part, with Landsat; but, more importantly, taken together, they are a marketplace in which the U.S. has been the leader until now.

In time, this marketplace will likely support the development of replacement hardware, but that will be a decade or more from now. In the meantime, the U.S. can either maintain its competitive position or allow the others to capture the business and sources of data when it is fully developed.

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IV. WHO'S IN CHARGE HERE?
OR
LEADERSHIP -- A CRUCIAL NEED NOW AND IN THE FUTURE

The apparent lack of strong government support for Landsat has been characterized as a budget problem. But it is in truth a problem of leadership and priorities. Landsat has moved from a technology development agency, National Aeronautics and Space Administration (NASA), to an agency with a set of operational missions, NOAA. While NOAA has no charter for land research or land management and, thus, has no internal need for Landsat services, it does operate the only other U.S. civil remote sensing system -- the meteorological satellites.

In reasonably good budget times, this rationale would seem adequate. But in very tight budget times, all agencies must set their priorities based on their core missions. In such an environment, it is obvious that NOAA does not, and will not, place Landsat at a high priority in its funding of programs.

Based on the above thesis, we explored likely locations for the support of Landsat within the executive branch of government. Because of the three themes (global environmental issues, international competitiveness, and economic intelligence) we concluded that the Department of Commerce, rather than NOAA, was an appropriate home for the on-going Landsat program. In addition, the relatively new "commercial space" assignment of the Department and the new Under Secretary for Technology should provide a potentially supportive environment for the program.

Commerce's Under Secretary for Technology could assume the lead responsibility to assess the nations remote sensing requirements. The legislative mandate set forth in P.L. 98-365 should be the cornerstone of this assessment. The Under Secretary could be asked to examine remote sensing as an example by which beneficial federally developed technology programs can be effectively transitioned to the private sector to maintain the nation's international economic competitiveness. While the group concluded that the Department of Commerce is currently the most appropriate home for the program, institutional arrangements must be evaluated to assure that over the long term, broad and inherent publicly derived benefits are taken into account as well as commercial viability.

Moreover, in the first six months of the Bush Administration, an interagency review will be undertaken to address the long term remote sensing goals of the nation. A number of policy options that should be included in such a review are listed in Appendix A. The President's Space Council could lead this review, assess the value of remote sensing to serve broad national goals and make appropriate recommendations including development of a lead cabinet department to implement these goals.

V. NEAR TERM ACTIONS

There are two key near term actions for the U.S. government. The government must continue to support the operation of Landsats 4 and 5, and the archive of Landsat data according to the arrangements made with the current operator, EOSAT. The government must also continue the development of Landsat 6 under the current arrangements. These two actions are fundamental to continuing the program toward the ends outlined above.

A third important near term action for the Government to take is the prompt release of the Congressionally mandated NOAA contractor studies of the "Advanced Earth Remote Sensing System" and the required NOAA action report to Congress on recommendations for such a system to follow Landsat 6. These studies and report should be made available immediately for public discussion, review by the interagency remote sensing review body and by the National Space Council, and be the subject of Congressional hearings on international competition and the continuity of U.S. civil land satellite remote sensing after Landsat 6.

In addition, there are a number of other near term actions that the government or the private sector can and should take to aid the immediate situation or to prepare for the longer term. These include:

- re-affirm the commitment of the U.S. to continuity of service from Landsat;
- improve the institutional oversight of the program (see "Who's in Charge Here" above);
- develop the "public good" arguments for continuing governments support;
- assess the consequences of <u>not</u> continuing the Landsat program and dependence on foreign sources of data; and
- organize the U.S. "Mission to Planet Earth" or "Global Change" initiative and put someone in charge of it with an adequate budget.

VI. LONGER TERM ACTIVITIES/GOALS

In the longer term, the U.S. Government and the private sector should rethink mechanisms for continuing the program. International cooperation, government/industry partnerships, combined land observing and meteorological satellites, and other mechanisms should be explored. Eventual complete transition to the private sector should be treated as a possibility and perhaps even a goal, for it appears to us that Landsat commercialization was attempted too soon and too abruptly.

Two major "themes" pervade the actions for the long term. One is the re-examination of mechanisms of providing continuity into the future. The second is the stimulation of the market for such data. The first is the basis on which a market can develop. The second is the ultimate basis for a financially successful enterprise on its own or in partnership with the government.

In Appendix A, we have identified a number of actions that the government and/or the private sector should undertake in the longer term in order to develop workable mechanisms to provide for future continuity of Landsat services.

VII. POSTSCRIPT

We wish to make it clear what we did and what we did not do in the course of our day and one-half of deliberations. We did probe the fundamental goals and near term actions needed to continue the Landsat program. We did not make a thorough examination of all of the many long term or policy options available to the government. As a part of the longer term reexamination of the mechanisms for continuing the program, all of these options should be examined carefully as possible components of the overall "architecture" of an ongoing U.S. program.

APPENDIX A

LONGER TERM ACTIONS OR POLICY OPTIONS FOR
GOVERNMENT-PRIVATE SECTOR DEVELOPMENT
OF ON-GOING LANDSAT PROGRAM

(In No Particular Order of Importance)

1. Conduct multiple hearings to access the advantages of continuing Landsat?

   - Hold Congressional hearings on what would happen if Landsat was terminated. Invite representatives from the national and international user communities, the value added industries, EOSAT, and NASA. Determine whether Congress will be comfortable appropriating money to allow the Department of Defense (DOD) to purchase SPOT or Japanese Earth Resource Satellite (JERS) data.

   - Evaluate the impact of International Consortia on the Landsat program.

   - Access the U.S. leverage on international observance of open skies and non-discriminating data access with or without the presence of Landsat.

2. Assessment of whether or not to continue the Landsat satellite remote sensing program.

   - Conduct an impact study to determine what happens if Landsat is terminated.

   - Identify short term requirement (within 1 year) needed to sustain operations.

3. National/International reassessment.

   - Determine if the U.S. should take the lead and assume greater responsibility for an international earth observing system.

   - The U.S. government must stabilize its policy and commitment before the U.S. can be trusted on the international scene.

   - Much of the future civilian space research and development will be multi-national. The U.S. should

have a strong voice and presence in this international arena.

- Re-establish credibility and continuity in civil remote sensing. The repeated threatened collapse of the Landsat program over the last 4-5 years has caused government and private sector users to switch to what are perceived as more secure sources of data. Turning our backs on this industry will result in dominance and dependance on Japan and European satellite data sources and products.

4. Establish a fixed institutional "home" for oversight of the program.

   - The system needs a home and institutional advocates. The new Space Council should determine the long term home for Landsat.

   - Establish a long term home that would serve as monitor, mediator and champion for the program and serve as a focal point for users and providers.

   - Determine when the institutional home should eventually be weaned to a regulatory role, if the program becomes commercially independent.

   - Analyze question of government's role to maintain the space segment, and how to make other government satellite data streams accessible to the user community.

   - NOAA is the home for oceans and atmosphere but not for land. This whole relationship should be reviewed.

5. Consider the eventual phase-out of government support.

   - What functions, if any, should government retain- archive, regulation, promotion, etc?

6. Commercialization of Space Remote Sensing requires a greater understanding of application demands:

   - Link user needs to system designers to design new systems that meet both science and commercial requirements.

   - Knowledge of user needs must also go back to private and public sensor developers <u>not just NASA</u>. A mechanism needs to be established to serve as a clearinghouse for science and commercial requirements.

7. Stimulate the global market.

   - Key responsibility falls to EOSAT and value added firms whose business it is to nurture.
   - Develop political constituency on the hill and in the administration.
   - Government needs to follow through its initial agreement to promote/support the program. The industry is at a volatile stage and still requires the government support originally foreseen when the contract was negotiated.
   - Link to major issues: drugs, deficit, balance of trade, environment, rain forests, acid precipitation.
   - Develop strategy for education and market development to gain strong global constituency.
   - Government can help by making data available on a timely basis, not by delaying for results from principal investigators (PI).
   - Support cooperative applied remote sensing research and development by industry and government. Expand on NASA's commercialization centers (CCD's) as a link to NASA remote sensing science and sensor development.

8. Create a strategy on education.

   - Who to educate and how to stimulate public knowledge.
   - Conduct education programs for K-12, university, graduate schools targeting different disciplines (scientific, business, community...), develop links to a "Space Grant College".
   - Stimulate application of remote sensing in disciplinary schools (forestry, finance, law, business, agriculture, geology, urban planning...). Set up on-line data bases of information for education and training.

9. Form an association of value added providers and end users to serve as an information source to stimulate demand and feedback needs.

   - Disseminate studies and become a clearinghouse for results of NASA commercial activities such as NASA Research Announcements (NRA) and the Centers for the Commercial Development of Space (CCDS) efforts.

- Obtain grants to be used to stimulate education/business community.

10. Examine all policy options for continued government support of Landsat including options such as:

- Allow the Landsat operator to share the satellite bus production line presently used for the spacecraft for Defense Meteorological Satellite Platform (DMSP) and NOAA's polar orbiters, thereby achieving economies of scale (i.e., Landsat pays only the incremental cost of its satellites).

- Provide to the Landsat operator capabilities (volume, power, viewing angle, etc.) on Government polar orbiters such as the NOAA morning S/C or the European polar platform.

- Allow the Landsat operator to share large launch service procurements (e.g., Titan-II) with a Government program (e.g., NOAA or DMSP).

- Provide tracking and data relay satellite system (TDRSS) access at no cost to Landsat.

- Fund the development of new technologies for Landsat system elements, particularly sensors (but including tape recorders, on-board processing, etc.).

- Provide a capital investment in the Landsat operator--a subsidy.

- Form a "crown corporation" with the Government as an investor with an expectation for return on investment.

- Form an international system for remote sensing with the French, Japanese and others to share capital costs for the space systems.

- Provide tax incentives for investment in the Landsat system

- Underwrite insurance for liability, loss of investment (S/C), and/or loss of revenue for the Landsat operator.

- Limit liability for the Landsat operator by law.

- Fund the costs of "technique development" for the analysis of Landsat data.

- Guarantee a continuing substantial government purchase of raw data from the Landsat operator.

- Allow (by a change in the Landsat law) the granting of exclusive rights to certain data sets to commercial purchasers of that data (i.e., allow, in fact, discriminatory sales).

- Grant exclusive rights to the Landsat operator to the commercial exploitation of data from NASA research satellite sensors and/or NOAA and DOD operational satellite sensors.

- Remove real or implied restrictions on technical capabilities (resolution, etc.).

- Make available radio frequencies not now available to private entities.

APPENDIX B

KEYSTONE LANDSAT POLICY WORKSHOP

October 28 and 29, 1988
Keystone, Colorado

PARTICIPANT LIST

Note: By the groundrules of the Keystone dialogue process, all participants attended the workshop as individuals, not as formal representatives of their organization.

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Mr. SCHEUER. Well, thank you very, very much, Dr. Bishop.

I now yield such time to George Brown as he may use.

Mr. BROWN. Thank you, Mr. Chairman.

Obviously, gentlemen, we don't have time to explore in detail the issues that you have raised here, and I regret that. Let me just raise a couple of questions, and this goes a little beyond the testimony you've made. It's to the importance and utility of the system.

One of the problems that we've had, and I guess all of the countries that have a satellite observation system have, is the large cost of the space segment compared to the commercial return from the products that result. And I wanted to raise the question and ask if any of you have any views as to the utility or desirability of possibly internationalizing the space segment under some sort of an agreement possibly similar to Intelsat, which deals with communications satellites, and then making the product available under a truly "open skies" arrangement, as Dr. Cline has suggested, to all users and all nations that might want to use the data, but leaving the very large cost of the satellite segment to be shared by the nations who are interested in participating in this.

And I recognize this may go a little beyond the specific area of expertise you have, but it's one of the suggestions that is made in the studies commissioned by NOAA, for example, and it is something that, of course, has been proposed by the French in connection with their proposal for Peacesat, an international agency for monitoring international agreements and conflict situations.

Mr. CLINE. May I make a brief comment on that?

Mr. BROWN. Certainly.

Mr. CLINE. I think you are absolutely correct. Not only will we be able to get adequate funding for an effort of this kind better if it is internationalized, but we will get more credibility for the use of that information. Because it takes real expertise and analysis to use a lot of the data correctly, and if we had the value-added services all coming from one place, there will be some reasonable question as to the validity of the interpretations that were being made.

So I think if we can get the United States Government to decide to commit on this point and to find a suitable group of reasonably neutral-minded nations not likely to be antagonistic to one another to sponsor the effort, I think it would be a very good idea. So it is something I support strongly.

Mr. BISHOP. Could I also respond, Mr. Chairman. I would throw a note of caution in along with what Ray Cline has just said. I happen to believe in an international arrangement as a good idea, but my notes of caution come from the fact that it usually takes a long time to make these arrangements. And so I would caution the committee——

Mr. BROWN. It's not a solution to the immediate problem of Landsat 4 and 5.

Mr. BISHOP. It's not a solution for the immediate problem and probably not for Landsat 6. It might be something for reconceptualizing in the future.

Mr. CLINE. Now don't hold your breath waiting.

Mr. BISHOP. Right. A further caution. For things like studying global change and global environmental problems it's a marvelous paradigm. For things like enhancing our competitive position in

the global economics sphere, it's not clear to me that it's an optimum solution.

And there are a set of other cautions that one could cause, but in the longer term I'd tend to be a believer.

Mr. BROWN. Well, if—Dr. Settle, do you want to comment on that from the standpoint of the resource community?

Mr. SETTLE. The caution that I would add, sir, is the fact that in the past we've run into some difficulties in having the providers of the data being really truly responsive to the marketplace, really providing the data in the form, with the timeliness that's required. As you well know, at the beginning when this was initiated as a NASA program it had a much more scientific kind of an orientation and really was just meeting the demands and the needs of people primarily in academia. And you just—this organization could be formed but it would have to be formed in such a way that it would take the demands of the marketplace very keenly into consideration. That's what was lost in the early stages of the program, I believe.

Mr. BROWN. If I may comment, that's going to be a problem with any commercial marketing. The quick turnaround feature, for example, that was mentioned as being key to Mediasat operations most prominently, and perhaps for some other operations, is going to have to be fed into the system if it's going to be truly useful and competitive. From what I understand of the GEOSAT operations, you don't need the quick turnaround as much as you do the specific kind of spectral data or stereoscopic data or other things that will allow you to analyze the data from a resource standpoint.

Mr. SETTLE. Well, let me clarify your understanding. There are many times we're called upon to make decisions relative to possibly lease sales in foreign areas that occur on fairly short time scales, so we have to seek partners to put together the capital that's required to participate in some of those kinds of sales. So we have driven by very short-turnaround-type time lines in many cases.

Mr. BROWN. But are you trying to tell me that you can't go back and get last year's data and make your decisions? Because if you're looking at geological information, it hasn't changed much.

Mr. SETTLE. There are certain instances in which that is true. However, we have found that by using the same—coverage of the same area over and over and over again that certain subtle structural features will actually be better expressed under certain vegetation patterns, snowfall patterns or rainfall patterns. So it's a little bit of a misunderstanding to think that just one picture of a given area will satisfy all geological users.

Mr. BROWN. Yes. All right. We need to analyze this as a part of our long-term policy development, not the short-term policy.

Dr. Cline, as long as I've got you here, I wanted to raise one issue which is extremely sensitive, being related to intelligence. You take a point of view which is not common amongst most members of the intelligence community, if I interpret them correctly. Is that right? The "open skies" policy.

Mr. CLINE. I think opinion is changing, sir. I'm no longer in the intelligence community. I'm a perfectly private citizen, but I do have a lot of friends who——

Mr. BROWN. Yes.

Mr. CLINE [continuing]. Have served in this community. I believe that as long as the U.S. Government has its particular intelligence requirements served within its classified material, the majority of the executives in the intelligence community now would accept the idea of commercialization and opening up of this technique for public use. The reason is that the genie is out of the bottle. And I think any of the people I've talked to about it realize you can't keep it inside classified, closed circles anymore, so why try? Just make sure we protect our own security, but let the benefits of economic development and peacekeeping and general public information about international security relations become part of the public record.

We will benefit from that. We are an open society, we can't lose. And we will benefit if everybody understands what the Soviet Union is doing, and what other people are doing.

Mr. BROWN. Well, I agree with you completely, as you know.

Mr. CLINE. I think you'll get the support if we follow this line now.

Mr. BROWN. Well, possibly so. I don't think the intelligence community has anything to fear, as you've indicated. And I say that because their own needs are very specific and are met by their own particular system.

Furthermore, by acting in such a fashion as to inhibit development of a viable healthy commercial operation, they are merely forcing that offshore, and the system that operates offshore is going to be even less responsive to their policy needs and concerns than if it were operated with a degree of U.S. control. And I think the intelligence community or some members of it have not thought through this whole situation adequately.

Mr. CLINE. I'll guarantee you to convince them if you get the policy which will support the whole program, sir.

Mr. BROWN. All right. Thank you very much, Mr. Chairman.

Mr. SCHEUER. Gentlemen, the time, the witching hour has arrived. It is now 5 o'clock. We must relinquish this room.

I can't thank you enough for your outstanding presentations. You would all make great Members of Congress because you can not only operate eloquently under the 5-minute rule but indeed under the 3-minute rule. You've really been marvelous. And the reason that I so confidently yielded to George Brown to use up the remaining time was that I'm also confident that we'll have you back again here in the very near future to help us think through the long-term public policy issues with which we must wrestle.

So I look forward to seeing you. I would ask any of you who would like to add some counsel and advice to us in addition to what Mr. Latham is going to submit, if you have any ideas on the issues that we ought to pose to the Space Policy Council that the Vice President is heading up, we undoubtedly will be meeting with him in the weeks to come, please get your submission in. We would value that and appreciate it very much. And surely we will be asking you back in the near future to counsel us again. This was an outstandingly fine panel. Thank you very much.

The hearing is adjourned at the call of the chair.

[Whereupon, at 5 p.m., the subcommittee was adjourned, to reconvene subject to the call of the chair.]

APPENDIX

CONGRESS OF THE UNITED STATES
HOUSE OF REPRESENTATIVES
WASHINGTON, D.C. 20515

ROBERT J. MRAZEK
3RD DISTRICT, NEW YORK

COMMITTEE ON
APPROPRIATIONS
WHIP AT LARGE

March 7, 1989

The Honorable James H. Scheuer, Chairman
Subcommittee on Natural Resources, Agriculture
Research, and Environment
H2-388 House Annex 2
Washington, DC 20515

Dear Mr. Chairman:

I would greatly appreciate your assistance in accepting the attached statement for the record of your subcommittee hearing on the "Proposed Termination of Landsat."

I fully support your efforts to save one of our nation's greatest resources. I hope you have a very successful hearing.

If you should have any questions, please have your staff contact Bob Katula at x5-5956. Once again, thank you for your assistance on this matter.

Sincerely,

Robert J. Mrazek
Member of Congress

RJM:rlk

143 MAIN STREET, HUNTINGTON, N.Y. 11743 • TELEPHONE: NASSAU (516) 671-8300, SUFFOLK (516) 673-6500

CONGRESS OF THE UNITED STATES
HOUSE OF REPRESENTATIVES
WASHINGTON, D.C. 20515

ROBERT J. MRAZEK
3RD DISTRICT, NEW YORK

COMMITTEE ON
APPROPRIATIONS
WHIP AT LARGE

Statement of Representative Robert J. Mrazek

Submitted for the Record

House Committee on Science, Space, and Technology

Subcommittee on Natural Resources, Agriculture Research,

and Environment

Hearing on the Proposed Termination of Landsat

March 7, 1989

Mr. Chairman and Members of the Subcommittee:

Today's hearing could well be a watershed in the five-year struggle to right our civilian/commercial land remote-sensing program. It has certainly been an on-going saga, the impact of which will be felt nationally and internationally if not constructively resolved in the next three weeks.

As I see it, the role you have chosen to pursue represents a most daunting challenge. Remote-sensing of the Earth by satellites is a discipline bounded by the jurisdiction of your subcommittee, as well as every committee and subcommittee in Congress. Therefore, I

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commend you for your willingness to hold a hearing on a subject as extensive and important as our civilian land remote-sensing program.

I fully support your subcommittee's efforts to solve the funding shortage regarding Landsats 4 & 5 for the remaining of FY 1989. I also believe Congress should fund the continued operations of these two satellites for as long as they continue to function.

Another important point, I feel, is equally obvious. While the simple act of resolving the Landsat funding crisis demands our immediate attention, the challenge facing our nation and your subcommittee today is to address problems that have been associated with our civilian land remote-sensing program since its inception.

For too long, our nation has known that Landsat is an invaluable resource. And yet, we have never really made an attempt to figure out where Landsat fits in with respect to our national security strategy. During the last 16-plus years, Landsat has lingered in a state between a research and an operational instrument, with an over-emphasis placed on commercialization of the data.

Meanwhile, global developments, along with the expanding information age, have placed a premium on systems such as Landsat. This apparent demand will become even more acute in the not-too-distant future. In short, our nation has a strong need to understand the rapidly changing world in which we live. We cannot afford to wait for a crisis of global proportions to happen. The sharing of information gathered by Landsat and all civilian remote-sensing satellites will go a long way toward increasing international

security and stability.

Specifically, our nation should develop a coordinated remote-sensing policy for the near and far term. This policy should include commercial endeavors, opportunites for international cooperation, environmental monitoring, foreign policy and public diplomacy efforts, and military-related security matters of a non-treaty specific nature. Finally, our civilian remote-sensing efforts should become an integral part of the United States national security strategy.

On a technological side of the ledger, our nation should make firm plans now to upgrade Landsat 7 with a sensor capable of imaging the Earth in the 2-to-4 meter range, in addition to a thematic mapper-type sensor already included on Landsats 4 & 5. The enhanced thematic mapper sensor, scheduled for launch on Landsat 6, would serve as a prelude to a technological leap of this nature.

Since the time for constructive, intergrated solutions is clearly at hand, I will soon introduce the International Security and Satellite Monitoring Act of 1989. The bill would create a national commission to examine three interrelated areas for analysis and recommendations with respect to our civil remote-sensing programs. Specifically, the commission would:

1. Determine how a revised open skies policy could enhance the national security strategy of the United States;

2. Review the status of the civilian remote-sensing programs of the United States and develop a series of recommendations toward

developing a long-term, coordinated policy; and

3. Study how the sharing of information, collected by civilian remote-sensing satellites cooperatively employed, along with other open information sources, could increase international security and stability.

The focus of the third point would be the role Earth-observation satellites could play in understanding and managing the global environment, particularly with respect to sustainable economic development.

Once we find a way to save Landsat, we should turn our attention to these larger policy issues. I hope my colleagues will closely examine and support my legislative effort in this arena. The time is ripe for action and it is my feeling that if a comprehensive policy is not developed soon, we are almost guaranteed to have similar hearings in the future on the possible demise of Landsat.

Therefore, given the larger policy questions facing our nation and the world, terminating two satellites in which our government has invested nearly $1 billion is a serious matter. The global environmental challenges that lie ahead can only be understood and managed with a systematic observation program from outer space. We do not have the luxury of time to wait until effects become noticeable and the climate begins to substantially change. Today's hearing can mark a departure point in that type of thinking.

STATEMENT OF THE HONORABLE TIM JOHNSON

Mr. Chairman, I wish to commend you and the rest of the Committee for holding this hearing in an effort to thoroughly study the problems facing Landsat, and hopefully, come up with solutions. I appreciate the leadership you have shown in this area.

Mr. Chairman, I am here to speak out against the shortsighted shutdown of the Landsat system. This program has been extremely successful in the past, and it seems senseless to let it die when the sum needed to keep the program operational is minimal. Hopefully, we can forge a cooperative agreement among those agencies that have the greatest reliance on this technology, such as the Departments of Defense, Commerce, Interior and Agriculture, to produce the necessary funding to keep Landsat running for years to come. I cannot believe that we are going to give up so easily in this field of satellite remote sensing when we currently lead the world.

While I understand certain funds have been forthcoming from the agencies that use the satellite images, as of yet we do not know how much has been raised. It is possible that the recently found funds for the program, which was announced just this morning, will only put off the death of Landsat for several months. Hopefully, this is not the case. However, if it is, we must continue pressing until we have the program on solid financial ground. These agencies must continue to cooperate so they continue reaping the benefits of the Landsat data. I believe it is a positive signal that Vice-President Quayle has given his support to this program through his hard work to find the necessary funding. As Chairman of the National Space Council, I am hopeful that Vice-President Quayle will continue to extend his support to Landsat, both through verbal words of encouragement and through the search for financial support. Now it is time to build upon this emergency support by finding the funding to put this program back on track. If we assume the problem is over just because we now have emergency short-term dollars and fail to

adequately address the underlying problems, the system will again be threatened by the possibility of a shutdown.

I foresee several dread problems in this shutdown. One is the fact that by quitting the race, we forfeit our technological preeminence and hand over the prize to our foreign competitors such as France, Japan, and the Soviet Union. Currently, our Landsat program brings in sorely needed foreign revenue. Without the program, we are forced to rely on our foreign competitors, which further increases our already substantial foreign debt. Instead of pulling back, this seems a prime area where the U.S. should be expanding. We already lead, so with sufficient capital input and research we could develop new technology and surge further ahead. It already seems that far too many electronic or technical devices available to consumers, whether cameras, VCRs, televisions, computers or others, says "made in Japan" or "made in South Korea" or made in some other foreign country. I will hate to see the day when the United States can no longer point to any commercial technological product where it excels or, in this case, leads the pack.

Another reason to keep this program going is that our world is currently facing the fact that the global climate may be changing. Furthermore, these changes could be catastrophic, disrupting traditional agricultural practices and regions, inundating coastal cities with water from rising oceans, changing economic patterns, and potentially affecting many current socio-cultural standards and practices. To adequately understand these changes, we need to study patterns of vegetation growth, changes in forestry and crops, Third World deforestation, and other important, changing phenomena. Without the Landsat satellites, our nation would lose the ability to generate vital information about all types of natural resources. Currently we have 17 years of stored data from the Landsat system. With this information to draw upon, we can begin to form our base of understanding and then build a model of our climate. Following this, we can begin to study the changes occurring. Any data we lose due to Landsat shutting down could be crucial. Only by understanding

these changes can we make the necessary public policy adjustments to reverse these dangerous trends or at the least, minimize their impact. Landsat is the sole source for much of this data.

It seems to me that we are receiving much in return for our modest investment. We cannot allow this program to fall through the cracks of commercialization, or finally succumb to the years of neglect and underfunding by the past Administration. Landsat has made an honest effort to transform itself into a private, commercial venture; however, it has several years to go before it can stand on its own feet, and now is not the time to be retracting our support. The federal government made a commitment to keep this program operational through 1991, and now we are faced with the fact that this part of the bargain is being maintained. At the least, Congress has the responsibility to keep Landsat operational through 1991. For a mere $9.4 million, Landsat will remain operational through the end of the year and the U.S. can continue reaping its benefits: the scientific, the technological, and the trade. By extending our aid to this beleaguered program, we will signal our commitment. Hopefully, through this effort, Landsat will forge new links with those departments listed earlier which rely on its services and with the scientific community which relies on this constant stream of data. Ultimately, this linkage will lead to an integrated program which does not have to depend on one undependable department for its viability.

We have no time to waste; we must act immediately to ensure that Landsat will not be faced with the prospect of shutting down in several months. Congress must work to find the funding to keep this program operational so that America has the tools to determine our world's fate regarding global warming and climatic change. In addition, by keeping this program operational the United States will continue to lead in the technological field of remote sensing. The added benefit is that we will continue to attract much needed foreign revenue. If Congress fails to act, we are not just talking about lost jobs, we are talking about losing another technological

race--our nation cannot afford to lose many more. I urge my colleagues to support the Landsat program, and I urge all involved to work together to find a way to keep this vital program running. Congress must retain its commitment to American technological excellence.

American Association of Petroleum Geologists

An International Geological Organization

Energy Minerals Division

Executive Committee 1988-1989

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The Honorable James H. Scheuer
Subcommittee on Natural Resources, Agriculture Research and Environment
Committee on Science, Space and Technology

March 6, 1989

Dear Mr. Chairman and Members of the Subcommittee,

I urge you to do what you can to assure continued operation of LANDSAT 4 and 5. These satellites provide geologic and environmental data helpful in energy and minerals exploration.

As the world's largest geoscientific organization, the American Association of Petroleum Geologists (AAPG) promotes the advancement of geological sciences and technology relating to the exploration and production of petroleum, natural gas and other energy mineral resources. Within the AAPG, activities in Remote Sensing are organized by the Remote Sensing Committee of the Energy Minerals Division. We would like you to consider the following points:

LANDSAT 4 AND 5 are success stories within the United States *technological infrastructure.* By shutting down these satellites, the United States is abrogating its technical leadership in this field.

The *global marketplace* for remote sensing services will be a different place if the U.S. exits. Each of the satellites (U.S., France, Japan, even the USSR) now -- or soon -- in the market is semi-unique. So the range of available service will be narrowed. LANDSAT 4 and 5's special strength is in dividing up the energy spectrum into more pieces, thus yielding information that has a qualitative difference.

The *terms of international trade* in remote sensing could be threatened. In spite of its former historic monopoly on remote sensing data, the U.S. set a good example with its "open skies" policy. The critical issue now is what may happen to U.S. access to foreign data. We should anticipate that a loss of U.S. voice will accompany the U.S. exit.

Geological exploration, contrary to what one might expect, requires an *ongoing source of remote sensing data.* Cloud cover is an

obvious problem. More than that, in many areas seasonal growth of vegetation provides important clues to soil and geologic features.

The *value of remote sensing* to users is large, but just how large is hard to pinpoint. Remote sensing is always used with many other tools and data. The "paper trail" from remote sensing to discovery is often cloudy -- this itself being a subject of continuing inquiry in our individual companies and in our scientific forums.

Explorationists are already paying a lot for remote sensing -- $1800 for a 99 km by 99 km area. By either raising fees and freezing out many current users or by dropping the service and eliminating this valuable screening tool altogether, the ultimate impact is to damage the cost-effectiveness, and quite possibly the absolute reach, of exploration. At a time when exploration funds are already exceedingly scarce, such steps would add insult to injury. This is not a time to further hobble the service provided by explorationists to the country.

With thanks for your consideration of these concerns.

Sincerely yours,

Jeremy Platt

Jeremy Platt
Pres., AAPG Energy Minerals Division

cc. N. Foster
F. Dix
R. H. Hopkins
S. Feldman
D. Towse

Statement of the

American Congress on Surveying and Mapping

and the

American Society for Photogrammetry and Remote Sensing

Tuesday, March 7, 1989 hearing

on the

Proposed Termination of Landsat 4 and 5

Subcommittee on Natural Resources, Agriculture, Research and Environment
Committee on Science, Space and Technology
United State House of Representatives

The American Congress on Surveying and Mapping (ACSM) and the American Society for Photogrammetry and Remote Sensing (ASPRS) appreciate this opportunity to present our views regarding the future of the Landsat Program.

The ACSM and ASPRS are national professional and technical societies with a combined membership of more than 18,000 individuals in surveying, mapping, remote sensing and land information science.

The societies are vitally concerned about the future of the Landsat Program. We strongly urge you to assure continued operation of Landsat 4 and 5 and to return the Landsat Program to its rightful place on the national agenda. The societies have already expressed our views to the President in a letter dated January 27, 1989 (see attached).

The ACSM and ASPRS believe that the Landsat Program has been one of this country's truly successful space programs. Landsat is the only spacecraft which is capable of producing systematic coverage of the Earth on a timely basis with

essential spectral wave bands. The data base which it supplies is desperately needed for global environmental monitoring, economic intelligence, and national security. It will become even more important as a support for the exotic sensors which NASA is planning as part of the Earth Observing System (EOS) component of the Space Station -- which will not be available until the late 1990's.

Although Landsats 4 and 5 are still functioning well in orbit, the satellites are scheduled to be turned off at the end of March -- not because they have exceeded their contract lifetime, or because their data is degraded, but simply for lack of approximately $10 million required to keep them operating through the end of this fiscal year (September 30, 1989). Once shut down, even though the program will eventually be restarted, the gap in the data will severely limit its applications to such issues as global climatic effects.

The societies believe that three actions are essential to assure the continuity of the Landsat program and thus the consistence of the global data base:

1. Provide Operating Funds for Landsats 4 and 5

The National Oceanic and Atmospheric Administration (NOAA) within the Department of Commerce has functional responsibility for the Landsat Program. Housed within NOAA, the U.S. civil remote sensing program is not receiving a high priority status and must compete with the agency's ocean and atmosphere programs for the limited budgetary funding available.

While other agencies use Landsat data extensively such as the Departments of Defense, Interior and Agriculture, similar problems exist within their budgetary structures. In order to provide funding for Landsat 4 and 5, these agencies would have to take funding away from their ongoing mandated programs. The agencies may be reluctant to do this.

Since a congressional request to fund the operations of Landsat 4 and 5 is unlikely from the Department of Commerce and the other agencies which use

Landsat data, the societies suggest that an alternative approach be strenuously pursued. Such approach would be for NASA to request the funding since it has responsibilities for certain aspects of Landsat. Additionally, NASA will need the Landsat data to provide a continuous data base for the future EOS program as previously discussed.

2. Provide Necessary Funding for Landsat 6

The societies urge Congress to provide funding to assure the completion, launch and operation of Landsat 6. Funding for the development of Landsat 6 is secured only through FY '89. Although the configuration of Landsat 6 is based on 25-year old technology and can never be cost-effective, it is the only system which the U.S. can build and launch by mid-1991 to assure continuity after the demise of Landsats 4 and 5. The annual battle to obtain funds for EOSAT to bring this system to completion has caused users worldwide to lose confidence in the U.S. commitment to provide continuity. They are rapidly converting to French, Japanese, and Russian sources.

3. Provide Firm Commitment for Development of Landsat 7

The Landsat Commercialization Act of 1984 required, and the NOAA contract with EOSAT specified, the development of Landsat 6 and 7. FY '88 funding for Landsat 7 was reduced to three contractor studies for an Advanced Civil Earth Resources Satellite. Though these studies were completed in August 1988, they are only now being released to the public. All three studies conclude that a fully commercialized system is not feasible at this time, and that the government must assume responsibility for at least the space segment. This is important so that data can be made available at reasonable cost and be widely applied. Currently, such data is only affordable by a few affluent customers.

The recently released studies pay limited attention to the sensor configuration for Landsat 7, despite the U.S. Geological Survey's (U.S.G.S.) formal proposal for a system which would provide high resolution (10m or better) multispectral data in stereo suitable for 1:50,000-scale global mapping with 20m contour interval. The ASPRS and the International Society for Photogrammetry and Remote Sensing endorsed the system

proposed by U.S.G.S. Additionally, some features of this system have been adopted by Japan for their Earth Resources Satellite ERS-1 scheduled for launch in 1992. The U.S. desperately needs a firm multi-year commitment to build such a system which could be operational by 1994-95 and provide data into the next century. If this country can make multi-billion dollar commitments for the Space Station, surely a commitment should be made for the Landsat Program which will provide vital information needed for the preservation of our fragile planet at a cost which appears miniscule by comparison. The societies believe that it isn't a matter of money but a matter of priorities.

ACSM and ASPRS respectfully urge Congress and the Administration to take the appropriate steps to implement the above-mentioned actions to assure a viable and competitive Landsat Program. The societies stand ready to assist in providing technical assistance.

ACSM ▪ ASPRS
American Congress on Surveying and Mapping
American Society for Photogrammetry and Remote Sensing
210 Little Falls Street ▪ Falls Church, VA 22046
ACSM (703) 241-2446 ▪ ASPRS (703) 534-6617

January 27, 1989

The President
The White House
Washington, D.C. 20500

Dear Mr. President:

On behalf of the 18,000 combined members of the American Society for Photogrammetry and Remote Sensing and the American Congress on Surveying and Mapping, we wish to extend our congratulations and best wishes for success in your Administration.

We also wish to bring to your attention an important national space satellite program which is in immediate danger of termination due to lack of funding. This is the Landsat satellite program which the National Oceanic and Atmospheric Administration (NOAA) recently disclosed will be forced to suspend operations of Landsat satellites 4 and 5 on March 31, 1989.

The Landsat Program offers mankind a truly systematic and repetitive view of the Earth at moderate resolution. While NASA has several related programs scheduled for the next decade, they are not responsive to our immediate needs. Continued availability of Landsat data is critical to ever-increasing numbers of data users throughout the commercial, governmental and scientific sectors -- not only in the U.S., but literally across the globe.

We strongly urge your Administration to work with Congress to restore the Landsat program to its proper position in the national agenda.

Recent issues of National Geographic and Time magazine indicate that the entire world is becoming acutely aware of our environmental problems and the Earth's fragility. The U.S. Congress has historically supported Landsat and we believe they will do so again but it requires the immediate support of your Administration.

We respectfully request your assistance on this matter.

Sincerely yours,

James L. Clapp
President, ACSM

Alden P. Colvocoresses
President, ASPRS

ROBERT G. TORRICELLI
9TH DISTRICT, NEW JERSEY

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Congress of the United States
House of Representatives
Washington, DC 20515

March 7, 1989

The Honorable James H. Scheuer
Chairman
NRARE Subcommittee
U.S. House of Representatives
Washington, D.C. 20515

Dear Jim:

I kindly request that you submit the following questions to the Assistant Administrator for Satellite and Information Services of the National Oceanic and Atmospheric Administration, Mr. Thomas N. Pyke, Jr. I would appreciate it if you would include both the questions and Mr. Pyke's responses in the Subcommittee's record for the Landsat hearing.

1) Vice president Quayle announced yesterday that he had raised enough money from various departments to keep Landsat functioning for a few months. Exactly how much has been raised, and will it keep Landsat going through the end of the fiscal year?

2) When will the Administration report on its plans for Landsat?

3) If Landsat 4 and Landsat 5 are are placed on internal control and remote sensing data is needed by the private sector in this country, where will it be able to purchase such data?

4) What is the cost of foreign data be relative to Landsat data?

5) What would an inactive status of Landsat 4 and Landsat 5 mean for the competitiveness of the U.S. remote sensing industry?

6) How would the shut down of Landsat 4 and Landsat 5 affect the next generation of remote sensing satellites? Would the United States still go ahead with the launching of Landsat 6 and Landsat 7?

7) Is it possible to reactivate the satellites once they have been placed on internal control? Please explain.

8) What is the quality/resolution of Landsat data relative to other remote sensing satellites with which it competes?

9) Will there be a marked improvement in the quality of the images with Landsat 6 and Landsat 7?

10) If there is a marked increase in the resolution of Landsat images with Landsat 6 and Landsat 7, what are the national security ramifications?

Thank you for your assistance on this matter.

Sincerely,

ROBERT G. TORRICELLI
Member of Congress

RGT:svo

STATEMENT FOR THE RECORD

BY

DR. THOMAS P. QUINN

PRINCIPAL DEPUTY TO
ASSISTANT SECRETARY OF DEFENSE
COMMAND, CONTROL, COMMUNICATIONS, AND
INTELLIGENCE

BEFORE THE
SUBCOMMITTEE ON NATURAL RESOURCES, AGRICULTURE RESEARCH AND
ENVIRONMENT

UNITED STATES HOUSE OF REPRESENTATIVES
COMMITTEE ON
SCIENCE, SPACE, AND TECHNOLOGY

7 MARCH 1989

MR. CHAIRMAN, MEMBERS OF THE COMMITTEE:

I APPRECIATE THE OPPORTUNITY TO COMMENT ON THE LANDSAT PROGRAM.

THE LANDSAT SYSTEM SUPPORTS MANY FACETS OF OUR EVERYDAY LIFE; SERVING COMMERCIAL, CIVIL, AND MILITARY PURPOSES. ITS APPLICATIONS ARE MANY AND VARIED, AND ITS AVAILABILITY HAS HELPED SPAWN THE DEVELOPMENT OF NEW AND INCREASINGLY MORE POWERFUL ANALYTIC TECHNIQUES AND EXPLOITATION TECHNOLOGIES THAT DIRECTLY AND INDIRECTLY BENEFIT AGRICULTURE, TRANSPORTATION, LAND MANAGEMENT, MAPPING AND CHARTING, ATMOSPHERIC AND OCEANOGRAPHIC STUDIES, AND MANY OTHER AREAS.

THERE ARE SEVERAL CHARACTERISTICS OF LANDSAT THAT MAKE IT VALUABLE. FOR INSTANCE, LANDSAT IS THE ONLY OPERATING SATELLITE THAT CAN PROVIDE A SINGLE IMAGE THAT COVERS AN AREA ON THE GROUND OF APPROXIMATELY 100 MILES ON A SIDE. THIS CAPABILITY MAKES LANDSAT IMAGERY ESPECIALLY WELL SUITED FOR ANALYSES OF AGRICULTURE, MINING, TRANSPORTATION, WATER RESOURCES, LAND MANAGEMENT, MAPPING AND CHARTING, AND OTHER TOPICS THAT ENCOMPASS LARGE LAND AREAS. DOD ROUTINELY USES THIS LARGE AREA COVERAGE DATA PROVIDED BY LANDSAT, ALONG WITH OTHER INFORMATION, TO ENHANCE SUPPORT TO OUR MILITARY OPERATORS AND TO IMPROVE THE CONFIDENCE LEVEL OF OUR ANALYSIS AND THE END PRODUCTS PROVIDED TO DEFENSE DEPARTMENT USERS.

LANDSAT IMAGERY IS UNIQUE BECAUSE IT IS COLLECTED BY SENSORS WHICH DISCRIMINATE BETWEEN INDIVIDUAL BANDS IN THE ELECTROMAGNETIC SPECTRUM, ENABLING PROCESSING TECHNIQUES TO SEGREGATE OR COMBINE DATA FROM THESE BANDS IN ANY COMBINATION. THESE SENSORS, THE MULTISPECTRAL SCANNER AND THEMATIC MAPPER, COLLECT DATA IN SEVEN SEPARATE ELECTROMAGNETIC BANDS AT RESOLUTIONS SUITABLE FOR ANALYSES OF VEGETATION, HYDROLOGY, GEOLOGY, AND OTHER EARTH SURFACE CONDITIONS. FOR EXAMPLE, LANDSAT PERMITS IDENTIFICATION OF FOREST TYPES, ROAD SURFACES, EXACT PARAMETERS OF MARSH LANDS, EVIDENCE OF NEW CONSTRUCTION--ALL OF VALUE TO MILITARY OPERATIONS, PARTICULARLY WHEN USEL IN CONJUNCTION WITH OTHER SOURCE DATA.

THE LANDSAT SYSTEM IS A U.S. OWNED AND OPERATED SYSTEM, AND HAS ADVANTAGES OVER NON-U.S. SYSTEMS: CURRENT AND PROJECTED FOREIGN SYSTEMS LACK THE NUMBER OF IMAGING BANDS WHICH ARE USEFUL IN MANY TECHNICAL APPLICATIONS AND EVALUATIONS. FURTHERMORE, FOREIGN SYSTEMS PROVIDE IMAGES WHICH COVER BARELY ONE-TENTH THE AREA COVERED BY A SINGLE LANDSAT SCENE.

THE DEVELOPMENT AND REFINEMENT OF DIGITAL PROCESSING TECHNIQUES, EXPLOITATION ALGORITHMS, AND VALUE-ADDED RESEARCH RELATED TO LANDSAT DATA HAS INCREASED IN RECENT YEARS. THESE TRENDS DEMONSTRATE GREAT PROMISE FOR IMPROVED OPERATIONAL EFFICIENCY AND PERFORMANCE ACCURACY IN MANY APPLICATIONS. NEW ALGORITHMS FOR AUTOMATED REGISTRATION, CHANGE DETECTION, FEATURE CLASSIFICATION, AND GEOGRAPHIC INFORMATION SYSTEMS ARE ALSO

ENHANCING THE UTILITY AND ECONOMY OF LANDSAT EXPLOITATION. IF LANDSATS 6 AND 7 ACHIEVE THEIR PLANNED INCREASES IN RESOLUTION AND COLLECTION CAPABILITY, FURTHER USES FOR DEFENSE PURPOSES COULD BE EXPECTED.

IT IS REGRETTABLE THAT THE PROPOSED DISCONTINUANCE OF LANDSAT 4 AND 5 OPERATIONS COMES AT A TIME WHEN EXPANDED DEFENSE APPLICATIONS ARE BEING DEVELOPED. ALTHOUGH THE LANDSAT SYSTEM IS NOT DESIGNED TO SATISFY SPECIFIC DOD REQUIREMENTS, WE HAVE FOUND LANDSAT IMAGE DATA TO BE A USEFUL CONTRIBUTOR IN THE OPERATIONAL PLANNING AND CRISIS SUPPORT AREAS. WE WOULD ANTICIPATE CONTINUED USE OF THE LANDSAT SYSTEM IF THE CURRENT FUNDING IMPASSE CAN BE RESOLVED.

THE DEPARTMENT OF DEFENSE HAS ALWAYS BEEN STRONG IN ITS SUPPORT OF THE LANDSAT PROGRAM. IN MAY 1987, THE DEPUTY SECRETARY ACKNOWLEDGED THAT DOD FOUND LANDSAT PRODUCTS TO BE VERY USEFUL AND THAT THE LANDSAT PROGRAM PROVIDED AN IMPORTANT INFORMATION SOURCE FOR A WIDE VARIETY OF DEFENSE APPLICATIONS. HE ALSO STATED THAT THE DEPARTMENT HAD EVERY INTENTION OF CONTINUING TO SUBSCRIBE TO THE SERVICES THAT THE LANDSAT PROGRAM PROVIDED. BECAUSE THE RESPONSIBILITY FOR THE MANAGEMENT OF THE LANDSAT PROGRAM, INCLUDING ITS TRANSITION TO A "COMMERCIAL" SYSTEM, HAD BEEN ASSIGNED TO THE DEPARTMENT OF COMMERCE, THE DEFENSE DEPARTMENT FELT THAT COMMERCE MUST BE PROVIDED WITH THE RESOURCES NEEDED TO CARRY OUT THIS RESPONSIBILITY. THE DEPUTY SECRETARY THEREFORE STATED THAT THE DEFENSE DEPARTMENT DID NOT

INTEND TO PROVIDE BUDGETARY SUPPORT FOR THE CONTINUATION OF THE LANDSAT SYSTEM. DUE TO THE CURRENT SITUATION, THE DEFENSE DEPARTMENT HAS ONCE AGAIN REVIEWED ITS POLICY ON LANDSAT FUNDING AND ITS USES OF LANDSAT DATA, AND HAS REAFFIRMED THE 1987 POLICY ON DOD FUNDING FOR LANDSAT.

THE DEPARTMENT OF DEFENSE BELIEVES IT HAS LIVED UP TO ITS FULL COMMITMENTS TO THE LANDSAT PROGRAM. WE HAVE BEEN EXCELLENT "CUSTOMERS," PURCHASING ABOUT 40-50% OF THE LANDSAT PRODUCTS SOLD TO GOVERNMENT USERS. TODAY'S SITUATION CLEARLY INDICATES THAT A COMPREHENSIVE, NATIONAL-LEVEL REVIEW OF THE PRESENT FUNDING AND OPERATING ARRANGEMENTS FOR THE OVERALL LANDSAT PROGRAM SHOULD BE CONDUCTED ON A PRIORITY BASIS. IN ORDER TO ENSURE THAT THE OPERATIONS OF LANDSATS 4 AND 5 CAN CONTINUE UNTIL THIS REVIEW IS COMPLETE, DOD IS PREPARED TO SHARE IN PROVIDING THE "STOP-GAP" FUNDING NECESSARY TO THAT END.

IN CONCLUSION, THE DEPARTMENT OF DEFENSE CONTINUES TO BELIEVE THAT THE LANDSAT PROGRAM IS A NATIONAL ASSET IN A TECHNOLOGICAL DISCIPLINE IN WHICH THE UNITED STATES HAS HISTORICALLY HELD A WORLD LEADERSHIP ROLE. WHILE IT IS NOT UNIQUELY BENEFICIAL TO THE DEPARTMENT OF DEFENSE, WE MOST CERTAINLY HAVE AN INTEREST IN PRESERVING, EVEN EXPANDING, OUR NATIONAL CAPABILITY TO COMPETE IN THE INTERNATIONAL HIGH-TECHNOLOGY ARENA OF MULTISPECTRAL SATELLITE IMAGING.

THANK YOU.

Statement by
James R. Donald
Chairperson, World Agricultural Outlook Board
U.S. Department of Agriculture
before the
House Committee on Science, Space, and Technology
Subcommittee on Natural Resources, Agriculture, Research and Environment
March 7, 1989

Mr. Chairman and members of the Subcommittee, I appreciate the opportunity to appear before the Subcommittee to discuss the Department of Agriculture's use of remote sensing data.

Remote sensing is an important data source used by the Department of Agriculture (USDA) in decisionmaking. Remotely sensed data from sensors carried on aircraft and satellites, such as the Landsats, are used effectively in both operational and research programs. USDA information systems, both existing and planned, will be improved in terms of timeliness, continuity, reliability, and objectivity through the use of digital data from satellite systems.

The Department is a user of satellite information and we will continue to purchase Landsat data so long as these are available.

Within the USDA, agricultural assessment and resource management are the two functional areas where satellite digital data are becoming an increasingly important source of information.

A major application of Landsat data in agricultural assessment is its use in monitoring the condition and expected production of foreign crops of economic importance to the United States. Frequently combined with data from other sources, digital data from the Landsat system help the Department's Foreign Agricultural Service to provide USDA commodity analysts with information about foreign crops that is more timely, reliable, and comprehensive. Landsat data give USDA analysts the opportunity to cover areas where travel is restricted or denied, or where agricultural statistics are scanty or of poor quality. It also allows us to analyze crop prospects with greater confidence, and, in particular, to delineate those areas where major changes are taking place.

Current domestic agricultural statistics are enhanced by use of Landsat data. During 1980-1987, the National Agricultural Statistics Service (NASS) demonstrated the utility of Landsat Multispectral Scanner (MSS) data, in improving the accuracy of crop acreage estimates in eight midwestern and Great Plains states. In 1988, NASS moved to an intensified and focused research effort in order to prepare for a rapid integration of the more advanced Landsat Thematic Mapper (TM) data anticipated from Landsat 6. NASS plans to return to an operational program in the early 1990's.

In addition, NASS has used Landsat image products to construct area sampling frames since 1978. These area sampling frames remain the foundation of accurate domestic agricultural statistics. NASS and NASA have a joint research project aimed at building these area sampling frames entirely on computer interpretation with proper graphics devices. NASS also has an international programs office that provides statistical assistance to developing countries. This office also operationally uses Landsat image products to build area sampling frames for those countries involved in the program.

In carrying out their respective mandated responsibilities for resource management, the Soil Conservation Service and the Forest Service are developing uses for digital data from satellite remote sensing systems. Using Landsat data for information, Geographic Information Systems (GIS) have been created for several national forests. Landsat data, in digital form, are integrated with other digitized data bases — terrain, vegetation types, transportation networks, and cultural features. The resulting systems improve forest management and enable rapid analysis of timber inventories, forest fire hazards, and wildlife habitats.

Research aimed at improving existing applications, as well as developing new applications of digital Landsat data, is receiving additional emphasis. The Remote Sensing Research Laboratory of the Agricultural Research Service, which provides significant research support to other agencies of USDA, is engaged in comparative studies of data from the Landsat and other civil satellite systems.

The President remains committed to the coordination of a comprehensive national space policy through the establishment of the National Space Council, to be chaired by the Vice President. To that end, the Administration is conducting a policy review of Landsat and, until that review is completed, is committed to operating the Landsat-4 and -5 satellites.

The major agency users of Landsat data and EOSAT are expected to cover the interim operating costs, the details of which are still being worked out. Congress will be informed of the interim financing plan shortly. The outcome of the policy review will also be presented in time for Congressional deliberations.

In the event that Landsat data were no longer available, this would delay and diminish our ongoing effort to improve the accuracy and efficiency of our estimation and monitoring of land cover with an ultimate impact on the timeliness and accuracy of crop estimates. A specific point: we would have a diminished capability for "quality control" over ground-based statistical data; data from satellite systems, such as Landsat, offer a parallel check, a chance to compare data from traditional land-based survey systems with an independent source.

I would like to point out that the USDA has already invested in research, equipment, data analysis, and personnel, not to mention the cost of Landsat data as such. This existing analytical structure could be adapted to other space-based data systems. However, a significant shift to satellite data sources other than Landsat would require expenditures for additional equipment, computer software, and additional time to re-establish the historical bases.

For many applications, such as crop condition assessment, we require data continuity over the same location for historical comparison. Switching to another high resolution satellite would require several years before effective historical comparisons could be made.

Because catastrophic failure of satellites has always been a possibility, we have had for several years contingency plans for the use of alternate sources. These plans call for the continued use of coarse resolution data from the polar-orbiting meteorological satellites. These data do not provide the detailed information needed for specific crop condition assessments, but do provide data from which we can derive general or qualitative assessments.

We may also use some high resolution data from foreign civil satellites for coverage of specific areas on a limited basis. This stopgap data might be of limited value since our crop condition assessment procedures are based on comparisons of historical data acquired over many years. The amount of data purchased for this stopgap activity would be determined by weather and agronomic events that happen during this period, but expenditures would not exceed current levels.

Mr. Chairman, I would like to reiterate that we support continuation of the Landsat program. I would be pleased to respond to any questions that you or members of the Subcommittee might have.

STATEMENT OF DALLAS L. PECK

DIRECTOR, U.S. GEOLOGICAL SURVEY, DEPARTMENT OF THE INTERIOR

BEFORE THE SUBCOMMITTEE ON NATURAL RESOURCES,

AGRICULTURE RESEARCH AND ENVIRONMENT

COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY

U.S. HOUSE OF REPRESENTATIVES

MARCH 7, 1989

Thank you very much for the opportunity to discuss the use of remote-sensing data from the perspective of the U.S. Geological Survey (USGS) and the Department of the Interior (DOI). We have supported the Landsat program since its inception almost 20 years ago, and we continue to find Landsat data useful to our programs.

DOI ROLE IN THE LANDSAT PROGRAM

The involvement of the DOI in satellite remote sensing began with the establishment of the Earth Resources Observation Systems (EROS) program in 1966. Under the leadership of USGS Director William T. Pecora, the EROS program provided the stimulus for an active program of remote-sensing research in the Department, and played a major role in defining the technical specifications for the Earth Resources Technology-1 Satellite, now known as Landsat 1. Since the launch of Landsat 1 in 1972, the USGS has had an important role in the Landsat program, with responsibility for processing, archiving, and distributing Landsat data, and conducting a research and technology transfer program to encourage the use of Landsat data. We have

cooperated with the National Aeronautics and Space Administration (NASA), who managed the Landsat program from 1972 until 1983, and the National Oceanic and Atmospheric Administration (NOAA), who assumed Landsat management responsibility in 1983. We now work with NOAA and the Earth Observation Satellite (EOSAT) Company, the commercial Landsat operator, to manage the Landsat data archive and handle customer orders and product generation at the USGS EROS Data Center in Sioux Falls, South Dakota.

During the period of NASA management, USGS appropriated funds and the income from Landsat data sales were used to cover the cost of Landsat data archiving and processing. Presidential Directive NSC-54 (issued in 1979) assigned the management responsibility for Landsat to NOAA. As part of this transition, USGS appropriations of $2.4 million for that program were transferred to NOAA in FY 1983. The revenue from Landsat data sales ($2.8 million in FY 1983) that formerly accrued to USGS also went to NOAA. USGS now provides Landsat support to NOAA and EOSAT with reimbursement from NOAA. We expect to receive $0.9 million from NOAA for the first half of FY 1989 for Landsat customer order handling and product generation. We have received $3.0 million from NOAA in FY 1989 for handling of incoming (new) Landsat data and data archiving/preservation. Part of our archive management activities includes development of a plan to convert the existing collection of Landsat digital data, now stored on magnetic tape, to a more permanent medium for long-term preservation of the data. A $2 million initiative in the President's FY 1990 budget will provide funds for the USGS to continue to protect this valuable Landsat data archive and make it available for future use.

On behalf of the civilian Federal Government agencies, the USGS administers a formal agreement with the EOSAT Company to purchase Landsat data products and services. The major Federal agencies purchased $4.0 million worth of data through this agreement in FY 1988, or approximately half of the total Landsat data sales handled by the USGS EROS Data Center for EOSAT. Of this amount, DOI purchases of Landsat data in FY 1988 totalled $0.3 million.

RELEVANCE OF THE LANDSAT PROGRAM TO DOI

DOI bureaus have invested in equipment and personnel to analyze remotely sensed data to meet the Department's land management, land- and water-resource assessment, and research missions. This investment has been made over the life of the Landsat program as our bureaus tested and evaluated the applicability of Landsat and other data for various bureau programs. Digital image processing facilities are now operated by the Bureau of Indian Affairs, Bureau of Land Management, Bureau of Mines, Bureau of Reclamation, National Park Service, and U.S. Geological Survey. The capital cost of the hardware and software in these facilities exceeds $25 million, and additional resources are provided for staff and space for the operation of this equipment. In some bureaus, these facilities are operated in conjunction with geographic information systems (GIS) because the results of remote sensing analysis (such as a land-cover classification or water-resource assessment) are useful inputs to data bases for GIS analysis.

The President remains committed to the coordination of a comprehensive national space policy through the establishment of the National Space Council, to be be chaired by the Vice President. To that end, the Administration is conducting a policy review of Landsat and, until that review is completed, is committed to operating Landsat 4 and 5 satellites.

The major agency users of Landsat data and EOSAT are expected to cover the interim operating costs, the details of which are still being worked out. Congress will be informed of the interim financing plan shortly. The outcome of the policy review will also be presented in time for congressional deliberations.

Landsat data are applied to many DOI programs. If Landsat data were not available, DOI bureaus would substitute older Landsat data, use data from satellites operated by other countries, or stop using satellite data for certain applications.

A listing of DOI applications of Landsat data which would be affected if the Landsat program ended is attached.

The specific impacts on DOI's programs would include:

o Decreased ability to monitor changing land and water features. Many DOI applications depend on monitoring features that undergo seasonal or long-term change, such as vegetation, water resources, snow, glaciers, land-cover/land-use patterns, flooding, and fires. The

lack of current Landsat data would affect applications requiring new coverage once or more each year, and over the longer term for those features that change more gradually from year to year. While NOAA Advanced Very High Resolution Radiometer (AVHRR) data are being used for some regional monitoring applications, these data are no substitute for Landsat data because of the limited spectral bands and low spatial resolution (1km) of the AVHRR sensors.

- Landsat data are cost-effective for large-area applications. Several bureaus have concluded that the area coverage and spatial resolution of Landsat data are cost-effective for many applications such as vegetation and land-cover mapping over large project areas. Even though data from the French Satellite pour l'Observation de la Terre (SPOT) system have acceptable spectral bands for such applications, it takes nine SPOT scenes to cover the area imaged by one Landsat scene. The processing, geometric registration, and mosaicking of data from several SPOT scenes is not cost-effective on a routine basis.

- Unique Landsat Thematic Mapper (TM) bands are not available from other satellite sensors. The Landsat TM bands (specifically the mid- and thermal-infrared bands, and also the visible blue band) provide unique data for mineral-resource assessment, vegetation monitoring, lake and reservoir assessment, and fire assessment. The SPOT and other foreign civil satellites do not provide data from these spectral bands. Opportunities for using SPOT data together with

Landsat TM data (where SPOT data provide high spatial resolution and Landsat data provide unique spectral information) would be reduced if current Landsat data were not available. Typical complementary uses include satellite image mapping, mineral-resource assessment, fire monitoring, and change detection.

- Landsat program interruption affects some DOI commitments to use satellite technology. DOI bureaus have made investments to use satellite remotely sensed data. DOI bureaus have formulated programs based on the availability of Landsat data, and there is no other civilian source for data of similar information content and coverage at comparable cost.

EFFECT ON STUDIES OF GLOBAL CHANGE

I would also like to comment, as Chairman of the interagency Committee on Earth Sciences of the Federal Coordinating Council on Science, Engineering, and Technology, on the implications of this action on our ability to study the processes of global change. The existing historical archive of Landsat data provides an important source of data for documenting relatively subtle (when considered on a global basis) changes that have occurred on the Earth's surface since 1972.

The DOI will be depending on continuity in the remote-sensing data record for global-change studies. For example, the USGS is studying changes in polar

sea ice and glaciers that may reflect patterns of global warming, and the Bureau of Reclamation plans to assess the impact of climate change on our water-resource systems.

Thank you for the opportunity to express the views of my bureau and the DOI on this important subject. I am hopeful that my comments, and those of my colleagues, will be useful to this Subcommittee.

ATTACHMENT

DEPARTMENT OF INTERIOR APPLICATIONS OF LANDSAT DATA

Bureau of Indian Affairs

- Land-cover mapping
- Monitoring the conversion of rangeland to agricultural land
- Mapping the extent and impact of fires

Bureau of Land Management

- Vegetation/land-cover analysis
- Monitoring surface disturbance associated with mineral exploration and development
- Habitat analysis
- Identification of unauthorized use of public lands

Bureau of Reclamation

- Monitoring general land-use/vegetation patterns and the extent of irrigated agricultural land in western U.S.
- Mapping surface water quality and estimating evaporation losses in large, remote reservoirs
- Mapping surface extent of snow cover for research supporting operational forecasting
- Studying reservoir water quality, snow mapping, and irrigated lands through international cooperative programs
- Comparing current Landsat data with historical data to study changes in vegetation, irrigated crop area, and reservoir water quality

National Park Service

- Inventory, management, and monitoring of resources; basic scientific research; and impact assessment for more than 50 million acres of Park Service lands
- Vegetation/land-use/land-cover analysis and wildlife habitat assessment
- Fire fuels analysis and determining the extent and impact of fires
- Location and identification of exotic plant species

U.S. Geological Survey

- Land cover mapping in Alaska--more than 250 million acres have been mapped in cooperation with the U.S. Fish and Wildlife Service, the Bureau of Land Management, and the State of Alaska
- Satellite image mapping of the U.S. and foreign areas (through foreign assistance programs)
- Monitoring changes in glaciers
- Mineral assessment in Alaska, where Landsat Thematic Mapper (TM) coverage is still incomplete

Minerals Management Service

- Studies of the forms, seasonal distribution, and movement of sea ice as it affects Outer Continental Shelf oil and gas leasing and marine mammal migration.

Landsat Status as of March 16

- The Administration has committed to continuing the operation of Landsats 4 and 5 at least until a National Space Council policy review of the Landsat program is completed.

- Landsat operations are expected to continue at the current performance level.

- NOAA's direction to EOSAT to shut down Landsat operations has been rescinded, but the formal go-ahead to continue operations beyond March 31 has not yet been given. The formal go-ahead awaits receipt of funds by DOC from other Federal agencies.

- Passing the hat among DOD, Interior, Agriculture, NASA, and OMB has resulted in identification of two-thirds of the $9.4 million necessary to continue Landsat operations at the current level for the remainder of the fiscal year.

- EOSAT has been asked to provide the remaining $3 million to cover the cost of operations for this period, but they have been reluctant to provide funding. The contract provides for EOSAT to be able to use its funds for Landsat operations.

- EOSAT has stated that they are in a cost overrun situation in the development of Landsat 6. Landsat 6 is being developed as a part of a fixed-price package that was negotiated as a contract amendment and signed last spring. At that time, neither the Administration nor the Congress had proposed any funding for continuation of Landsat operations beyond September 30, 1988. There was no tie-in contractually between continued operations funding from the Government and the fixed-price contract for the development of Landsat 6.

- As a part of the package, EOSAT was given a $10.8 million interest-free loan, which they are to pay back out of EOSAT net annual profits through a series of payments made each March based on EOSAT's profits for the preceding calendar year. That pay-back is not contingent on any particular scenario for Landsat operations. Because of the uncertainties associated with Landsats 4 and 5, EOSAT conceded during negotiations that the pay-back would include profits from Landsat 6 in the future, as well as from whatever pay-back could be achieved earlier as derived from the sale of either current or archived data from Landsats 4 and 5.

- Commerce is prepared to provide direction to EOSAT under the contract to extend operations beyond March 31 as soon as it has received funds from the other agencies and, hopefully, EOSAT's commitment to participate in this funding package.

EOSAT NEWS

Earth Observation Satellite Company

FOR IMMEDIATE RELEASE
More Information, Contact:
Richard Mroczynski, Director of Public Affairs
(301) 552-0545
(800) 344-9933
RCA TELEX: 277685 LSAT UR

89-7

SHUTDOWN OF U.S. LANDSAT SYSTEM HALTED

Funding To Be Continued During Space Council Policy Review

Lanham, Maryland, 15 March 1989 - Today the U.S. Department of Commerce rescinded its March 1 shutdown order and reinstated operations of the Landsat 4 and 5 Earth remote sensing satellites. Coordination earlier this week by Vice President Dan Quayle and the new National Space Council helped to expedite a pledge of funds until a policy review of Landsat could be completed. The amount and duration of funding for the satellites has yet to be announced.

Earth Observation Satellite Company (EOSAT), the operator of the Landsat system under NOAA, has resumed data orders and is quickly alerting a worldwide Landsat user community of the news. "Thousands of Landsat data users have been alarmed by the possibility of losing this resource - we are thrilled to tell them that this critical international program will continue," said C.P. Williams, EOSAT President. "We feel that the hard work and close coordination by the Congress and the new Administration were key in resolving this problem," he said.

- MORE -

In testimony March 7 before the House Committee on Science, Space and Technology, Thomas N. Pyke, Jr., NOAA Assistant Administrator for Satellite and Information Services, presented the position of the new Administration: "The President remains committed to the coordination of a comprehensive national space policy, through the establishment of a National Space Council, to be chaired by the Vice President. To that end, the Administration is conducting a policy review of Landsat and, until that review is completed, is committed to operating the Landsat 4 and 5 satellites."

The policy review by the National Space Council is expected to outline whether a need exists for Landsat 4/5, a funding package for Landsat 4/5 operations through fiscal 1990 and 1991, and U.S. government agency responsibility and participation in the Landsat program.

The transition of the Landsat program from public to private operation began in 1985, and is under the oversight of the Secretary of Commerce until 1994 in accordance with Public Law 98-365 (The Land Remote Sensing Commercialization Act of 1984). Since assuming operations of Landsats 4 and 5, EOSAT has reduced operations cost by fifty percent, and has established an international marketing effort to create a remote sensing market for the 1990s when it assumes fiscal responsibility for Landsat.

UNITED STATES DEPARTMENT OF COMMERCE
The Assistant Secretary for Administration
Washington, D.C. 20230

March 15, 1989

Mr. Charles Williams
President, Earth Observation
Satellite Company
4300 Forbes Boulevard
Lanham, Maryland 20706

Dear Mr. Williams:

My direction to implement the Landsat 4 and 5 Shut Down Plan set forth in my letter dated March 1, 1989, is hereby rescinded. The Administration announced its commitment to the coordination of a comprehensive national space policy, through the establishment of the National Space Council, which will conduct a policy review of Landsat. We anticipate that funds will be available to fund the continuation of L-4/5 operations until the completion of this review.

This letter does not extend the contract performance period or increase the Government's contractual obligations beyond the amounts already funded. However, in anticipation of such funding we are rescinding the shut down directive.

Sincerely,

Joseph L. Gray
Contracting Officer

ROBERT A. ROE, New Jersey, CHAIRMAN
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Republican Staff Director

U.S. HOUSE OF REPRESENTATIVES
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
SUITE 2321 RAYBURN HOUSE OFFICE BUILDING
WASHINGTON, DC 20515
(202) 225-6371

May 4, 1989

Hon. Dan Quayle
Vice President
White House
Washington, D.C.

Dear Vice President Quayle:

The National Space Council will meet next week to discuss the future of the Landsat remote-sensing satellite system. As you are aware, the Science, Space, and Technology Committee has strongly supported the development of the Landsat system, from its early days as a NASA program through its commercialization under the Land Remote-Sensing Commercialization Act of 1984.

The National Space Council's review comes at a critical time in Landsat's history. Funding for Landsats 4 and 5, which was threatened before your intervention in March, runs out in early July. Landsat 6, not scheduled for launch before mid-1991, offers only a single satellite with slight technological improvements over the existing system. With Landsat's history of budget cuts, threatened program shut-downs, and system downscoping, users and potential users of Landsat all over the world have called into question the United States' commitment to its civilian remote-sensing program. Our international competitors -- particularly the French and the Soviets -- have aggressively capitalized on our indecision.

We urge the Council to reaffirm strongly this nation's commitment to a technologically-advanced, internationally-competitive civil remote-sensing satellite system.

Landsat's importance is clear. Maintaining the Landsat program is critical to the national security as a unique source of military and economic intelligence. At a time when the world has become aware of the fragility of its natural resources and the threat of environmental disasters, Landsat has become a critical tool for environmental knowledge and management around the world. And the commercial market for Landsat data -- from finding oil and gas to planning new school districts -- has been growing dramatically.

But we can no longer afford the annual ritual of agony over the Landsat program. We need a long-term, stable policy for the rational

development of the Landsat system. We urge the Council to include the following elements in a long-term Landsat policy:

1. Beyond Landsat 6, the government should commit to developing and launching a system to take us at least to the year 2000.

2. Industry should continue to play a critical partnership role with the government, both to reduce the government's costs and to bring the private sector's expertise in marketing to bear.

3. Estimates of the potential commercial market should be realistic, not driven by ideology. Efforts to commercialize the Landsat system should be paced by the development of sufficient commercial markets. Commercialization can be successful only with a long-term, predictable government policy and sufficient government support.

4. The technology of future Landsats should be sufficiently advanced to be internationally competitive.

5. International financing arrangements should be pursued only when the U.S. is committed to a stable, long-term program. We should negotiate with potential international partners from a position of strength, not weakness.

6. Funding for Landsat 4 and 5 operations should be secured to ensure continuous data coverage and to reassure users of the U.S.'s commitment to the Landsat program.

We commend you for your continued leadership on this critical space policy issue, and look forward to working with you and the other Members of the National Space Council in putting the Landsat program back on the right track.

Sincerely,

Bob Walker

ROBERT S. WALKER
Ranking Republican Member

Robert A. Roe

ROBERT A. ROE
Chairman

THE WHITE HOUSE

Office of the Press Secretary
(London, England)

For Immediate Release June 1, 1989

STATEMENT BY THE PRESS SECRETARY

The President today announced he had approved funding for continued operations of Landsat satellites 4 and 5 and for the completion and launch of Landsat 6. The President's action endorsed a recommendation from the National Space Council chaired by Vice President Dan Quayle. The President also directed the National Space Council and the Office of Management and Budget to review options with the intention of continuing Landsat-type data collections after Landsat 6.

Landsat, which takes detailed photographs of the earth, is the U.S. Government's civil, space-based, land remote sensing program. Landsat-type imagery data is important for such applications as global change research, environmental monitoring, law enforcement, natural resource estimates, national security and a variety of private sector uses. In addition, Landsat provides a visible symbol of the U.S. commitment to, and leadership in, the use of space for the common good.

Over recent years, it has become increasingly evident that commercializing the entire Landsat program would not be feasible until at least the end of the century. Since earlier government planning was based on commercializing the entire program, the absence of near-term commercial viability threatened continuity of Landsat and jeopardized continuity of Landsat data. The National Space Council, at its first meeting on May 12, recommended the action endorsed by President Bush today.

Continued operation of Landsats 4 and 5 will require an additional $5 million in FY89 and $19 million in FY90. Cost of completion and launch of Landsat 6 by 1991 has already been included in the Commerce Department budget.

# # #

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